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Aleksander WRÓBLEWSKI

Krajowe gatunki z rodzaju *Micronecta* KIRK. (*Heteroptera, Corixidae*)

Польские виды рода *Micronecta* KIRK. (*Heteroptera, Corixidae*)

The Polish species of the genus *Micronecta* KIRK. (*Heteroptera, Corixidae*)

[Pl. XXIII—XXVIII, 17 textfigures and 6 maps]

Contents:

I. INTRODUCTION

Initially the aim of my studies on the Polish species of the genus *Micronecta* KIRK. was to provide merely a brief note, supplementary to the known revision of JACZEWSKI (1924), in which he established also the subfamily-name *Micronectinae* (now in general use), but had not dealt with the representatives of this group, his material being too scarce.

Ever since 1936, when collecting *Heteroptera* I have given particular attention to representatives of the genus *Micronecta* KIRK. My first result was the discovery of *M. poweri* (DGL. SC.) in Poland (WRÓBLEWSKI, 1939 b) and the observation of pterygo-dimorphism in this species. After the last war my field work was mostly occasional till 1953, when WAGNER's (1952) important paper urged me to speed up and to extend my studies. The key given by WAGNER in that paper enabled me to find in my material the fourth species [„*M. minutissima* (L.)", *M. meridionalis* (COSTA) and *M. poweri* (DGL. SC.) having been previously recorded], correctly discerned by LINNAVUORI (1951) though wrongly recognized by him as a new one. The deficiency of WAGNER's paper by which I was greatly struck, was the wrong interpretation of the pterygo-dimorphism. The macropterous forms were still regarded by him as separate species. Conspicuous differences in the shapes of these forms are no excuse for this error since now the specific diagnoses based on sexual characters, especially on the parameres of the ♂♂ enable us to identify the species in both forms quite correctly.

In spring 1953, when preparing to start more regular field investigations I decided to pay particular attention to the variability of some selected morphological features. For this I had to take sufficiently numerous material from as many habitats as possible from all over Poland. This was also indispensable for finding out the geographical distribution of the particular species in our country.

It was not until autumn 1955 that I decided to carry out a systematical revision of the European members of the genus. The doubts concerning *M. carpatica* sp. n., which seemed at first to agree with the descriptions of some of HORVÁTH's species, induced me to write to the Hungarian Museum of Natural History (Természettudományi Múzeum) at Budapest and to ask for the loan of some specimens from HORVÁTH's materials. The kindness with which the Museum Direction answered surpassed my boldest expectations. The whole of G. HORVÁTH's most valuable material of *Micronecta* KIRK., among others the types of almost all species described by that author, was sent me for study. Without this material any revision would be uncertain and scarcely possible.

My ecological observations were made mostly occasionally, nevertheless some of them, e. g. concerning the importance of the depth of waters, seem worthy of notice. A clay-pond at Karolin (suburb of Poznań) is the only one of the investigated habitats which is described more exactly in this paper. This pond is peculiar for being inhabited

by as many as four species of *Micronecta* KIRK. and I studied it therefore with particular care. The pond was often visited, samples were taken there 30 times, I observed also there the phenology and partly the larval development of the species.

My own material for the present study consists of over 18 800 specimens (about 16 400 imagines) collected at 259 habitats dispersed throughout Poland. Their dispersal is, however, by no means uniform, as nearly half of the habitats lay in the province of Poznań. In several waters collecting was repeated in order to get records of changes in the populations. In my field work I mainly used a hand-net and sometimes a dredge. The material was preserved in 70 per cent alcohol. About 20 per cent of the specimens were micrometrically measured (length and breadth of body, head and pronotum, synthlipsis etc.). Over 400 specimens were dissected and mounted as microscopical preparations in Faure's liquid. I made use of these preparations when studying the variability of the shape of the parameres and other details of the structure of the abdomen in the ♂♂. Exact measurements were made of the parts of the legs, of the antennal joints, of the wings and of the hemielytra. Specimens mounted in preparations were mostly ♂♂, though some of the ♀♀ of every species were prepared and measured too. It was found that in the proportions of the parts of the legs (fore legs excepted) there is no discernible sexual dimorphism.

Some 80 per cent of my material I have collected personally, for the remainder I am indebted not only to my colleagues and friends, especially to Mrs. J. JASKOWSKA, Mrs. E. SMOLEŃSKA, Mr. L. BERGER and Mr. A. TSCHUSCHKE, but also to many other persons. To all of them I wish to express my sincere thanks. I am especially obliged to Prof. Dr. T. JACZEWSKI, Director of our Institute. His valuable instructions and the great interest he showed, supported and enriched my study. I wish to express my sincerest thanks to the Direction of the Természettudományi Múzeum at Budapest and in particular to Dr. E. HALÁSZFY for making HORVÁTH's materials available.

II. REVIEW OF THE LITERATURE CONCERNING THE EUROPEAN SPECIES OF *MICRONECTA* KIRK.

It is certainly the minute size of the European members of the genus which is responsible for the insufficient attention with which they are treated by many heteropterologists. Nevertheless the literature dealing with them is rich enough. Its oldest item is the Linnean diagnosis of *Notonecta minutissima* LINNAEUS, 1758. The short description agrees with every European species of *Micronecta* KIRK. but as the type is missing it is now impossible to decide which of them is the true Linnean one.

When FABRICIUS introduced the name *Sigara* FABRICIUS 1775, for all the *Corixidae* known at his time, he placed in it also his species *Sigara minuta* FABRICIUS, 1794, which may be a synonym of the Linnean species. The generic name *Sigara* has been used for a long time. When other species of *Corixidae* were separated as the genus *Corixa* GEOFFR. (*Corisa* FIEB.) the members of the present genus *Micronecta* KIRK. retained the name *Sigara* until 1897.

Generic type, by original designation by KIRKALDY (1897): *Notonecta minutissima* LINNAEUS, 1758 = *Micronecta minutissima* (LINNAEUS, 1758).

The second European species to be described was *Sigara leucocephala* SPINOLA, 1837, from Sardinia. Owing to its peculiar geographical distribution it was never confused with any other species. The two above species, as well as four others from India, were taken into account by FIEBER (1844) in his monograph. Very probably (see p. 293) *Sigara minuta* FIEBER, 1844, is not the same species which is now regarded as *M. minutissima* (L., 1758).

The third European species successively described was *Sigara meridionalis* COSTA, 1860. It was indeed distinguished earlier by SCHOLZ (1846) but not described, thus its name *Sigara Scholtzii* FIEBER, 1851, should be considered as a nomen nudum. To the three above mentioned species FIEBER (1861) adds a fourth: *Sigara lemana* MEYER (Cat. Rh. d. Schweiz). He must be regarded himself as the author of this species, since his is its only description known at all. The diagnosis is insufficient to identify this species, nevertheless some details of it, and above all the kind of waters inhabited by *M. lemana* (FIEBER, 1861) contradict the statement of HORVÁTH (1899), that it is identical with *M. minutissima* (L., 1758).

Sigara Poweri DOUGLAS and SCOTT, 1869, the next described species, was regarded by REY (1890) and all later authors as merely a variety of *M. minutissima* (L.); only in 1938 WALTON (1938) restored its position as a good species. *Sigara foveifrons* THOMSON, 1871, is according to LUNDBLAD (1928) identical with *M. minutissima* (L.). The first macropterous form mistaken for a new species was *Sigara distans* REY, 1890.

The next two species were described by HORVÁTH (1895). They were *Sigara pusilla* HORVÁTH, 1895, from Hungary and *S. vitticeps* HORVÁTH, 1895, from Bosnia. The first of them is macropterous and seems identical with *M. capitata* HORVÁTH, 1899, described later, the second resembles *M. poweri* (DOUGLAS and SCOTT, 1869), but also *M. griseola* HORVÁTH, 1899. A doubtless identification is not possible (at least at present) the types of both species being females. Much more important is HORVÁTH's (1899) synopsis in which he gives a revision of all Palaearctic species of *Micronecta* KIRK. that were then known to him. Among the 22 species dealt with in the key there are not less than 13 then newly established by this author. New to Europe are 6, namely: *Micronecta semilaevis* HORVÁTH, 1899, *M. perplexa* HORVÁTH, 1899, *M. griseola* HORVÁTH, 1899, *M. latiuscula* HORVÁTH, 1899, *M. brachynota* HORVÁTH, 1899, and *M. capitata* HORVÁTH, 1899. The great authority of HORVÁTH fixed for a long time most of these species, though many of them have now been proved to be merely synonyms. Two „species", namely *M. semilaevis* HORVÁTH, 1899, and *M. perplexa* HORVÁTH, 1899, are simply macropterous forms, the first of *M. meridionalis* (COSTA, 1860), the second probably of *M. poweri* (DOUGLAS and SCOTT, 1869), or of *M. griseola* HORVÁTH, 1899 (the types are females). *M. capitata* HORVÁTH, 1899, may be on the contrary, a brachypterous form of *M. pusilla* (HORVÁTH, 1895), described previously. *M. brachynota* HORVÁTH, 1899, is doubtlessly identical with *M. meridionalis* (COSTA, 1860); as to *M. latiuscula* HORVÁTH, 1899, nothing new can be said as the specimens are missing from HORVÁTH's material. According to POISSON (1938) it is very similar to *M. capitata* HORVÁTH, 1899, or transitional between this species and *M. meridionalis* (COSTA, 1860). *M. griseola* HORVÁTH, 1899, should be regarded as a quite valid species. It is one of the principal tasks of this study to clear up and to establish the proper position of this species. Another species described by HORVÁTH is *M. rugicollis* HORVÁTH, 1901, from Finland, in which LINDBERG (1924), LUNDBLAD (1928) and now myself too have recognized *M. minutissima* (L., 1758). The following species described by HORVÁTH from Hungary *M. nanula* HORVÁTH, 1916, and *M. episcopalis* HORVÁTH, 1916

have also proved to be invalid. The types of the first belong to *M. griseola* Horváth, 1899, and of the second to *M. pusilla* (Horváth, 1895), being its brachypterous form of a smaller size. Its smallness may be a result of living in the peculiar conditions of its habitat: „Püspökfürdó prope Nagyvárad ubi in lacu acratothermali (33,7° C.) copiose vivit".

The first paper dealing with the biology of *Sigara minutissima* (L.), or more probably *M. griseola* Horv., was that of Hagemann (1917). Besides the morphology, the respiration and the stridulation are discussed in it.

A significant progress in the investigations of the European species of *Micronecta* Kirk. was made by Lundblad (1928). Following the example of Jaczewski (1926) who in the description of the African species *M. signoreti* (Reut.) gave figures of the male parameres, Lundblad (1928) describes the parameres of *M. minutissima* (L., 1758), and of *M. meridionalis* (Costa, 1860). His assumption, that the species described by him as *M. minutissima* (L., 1758), is undoubtedly the Linnean one, as it is the only species of the genus in Sweden, lost much of its certainty when Lundblad himself found another species — *M. borealis* Lundblad, 1936, occurring in that country. Nevertheless, since the Linnean type is lacking we have to accept the proposal of Lundblad (1928) and to regard *M. minutissima* Lundblad, 1928, as identical with *M. minutissima* (Linnaeus, 1758).

Walton (1938) recognized in the above mentioned *M. borealis* Lundblad, 1936, *M. poweri* (Douglas and Scott, 1869). Walton's paper deserves attention as it discerns the macropterous and brachypterous forms in *M. meridionalis* (Costa) and in *M. poweri* (Dgl. Sc.). Detailed descriptions of the three English species are well illustrated and give also the relative lengths of the parts of the legs. The observations on the feeding mechanism are valuable, although the account of the development of *M. poweri* (Dgl. Sc.) is rather misleading. The life history of *M. minutissima* (L.) is discussed by Jordan (1937). It is very probable, that he had to do actually with *M. griseola* Horv. The sizes of the larvae seem to confirm this supposition.

Similar observations on the life and development of *M. meridionalis* (Costa) were made by Poisson (1935). Another

of his papers (POISSON, 1938) giving a detailed study of all French species of *Micronecta* KIRK. is much more important. He had at his disposal not only abundant material of his own but also materials of other collectors, as well as the types and paratypes of several species. Apart from 8 French species exactly described and richly illustrated he takes into account 29 others, discussing many of them quite extensively, with new morphological features and valuable notes added. Nevertheless POISSON's study did not fulfil its role as a revision, being not sufficiently critical. Having ascertained the resemblance of the parameres in the ♂♂ of *M. semilaevis* HORVÁTH, 1899, and of *M. meridionalis* (COSTA, 1860), POISSON does not notice that the first is simply the macropterous and the second the brachypterous form of the same species. Though the occurrence of *M. minutissima* (L., 1758), in France is not improbable this does not result from POISSON's study. The specimens determined by him as *M. minutissima* (L., 1758), belong undoubtedly to *M. poweri* (DOUGLAS and SCOTT, 1869), their pattern being somewhat less distinct. Whatever doubts there might have been, they would have been cleared up had he considered the shape of the prestrigilar flap of the ♂♂, but in his study POISSON disregards this important character entirely.

JORDAN describes *M. macrothoracica* JORDAN, 1943, a new species from Germany, comparing it with *M. perplexa* HORVÁTH, 1899. Apparently this new species is a macropterous *M. poweri* (DGL. SC., 1869). As to his account of *M. perplexa* HORVÁTH, 1899, it is not exact and misleading, though JORDAN has examined the „types" and other specimens determined by HORVÁTH.

The Italian species of *Micronecta* KIRK. are dealt with by TAMANINI (1948). Among others he notices the macropterous forms in *M. leucocephala* (SPINOLA) and in *M. meridionalis* (COSTA). His *M. nanula* HORVÁTH, 1916, is probably not identical with *M. griseola* HORVÁTH, 1899, (as are the types in HORVÁTH's material). I have examined a ♂ of the same origin as a ♀ mentioned by TAMANINI (Genova, Mus. Civ. Busalla, DODERO 82) and found its right paramere resembling *M. minuscula* POISSON, 1929. TAMANINI (1948) takes under

consideration the interior structure of the aedeagus. HOBERLANDT (1948) intended to complete the description of *M. vitticeps* (HORVÁTH, 1895), but his specimens, collected at Edirne (European Turkey), if they are not *M. meridionalis* (COSTA, 1860), then quite obviously belong to the „*meridionalis*" - group. Thus they have not much in common with HORVÁTH's species, which is undoubtedly a member of the „*minutissima*" - group.

LINNAVUORI (1951) created one more synonym for *M. minutissima* (L., 1758), describing *M. wagneri* LINNAVUORI, 1951, from Finland. Overlooking POISSON's (1938) paper he mistook *M. griseola* HORVÁTH, 1899, for *M. minutissima* (L., 1758), and did not recognize the identity of his new species with the true *M. minutissima* (L.) in LUNDBLAD's (1928) interpretation. WAGNER (1952) who described a new species, *M. cornuta* WAGNER, 1952, and in the same paper published a key to the German members of the genus made the same error as LINNAVUORI (1951). As to *M. cornuta* WAGNER, 1952, it is in my opinion a lacustrine, summer form of *M. poweri* (DGL. SC., 1869).

Lastly STICHEL's (1956) new synopsis may be mentioned. It does not add anything new. This author has put in it uncritically together nearly all species (18) described whenever from Europe. As criteria used in the key are chiefly those of coloration, and of head and pronotum proportions. The sexual characters, especially the parameres of the ♂♂ are disregarded completely and thus the identification can never be absolutely sure.

Apart from the papers and works discussed above there are many others containing valuable observations and accounts made more or less casually in connection with hydrobiological and heteropterological investigations. To some of them I shall refer later.

III. SYSTEMATICAL PART

1. *Micronecta meridionalis* (COSTA)

Sigara Scholtzii SCHOLZ, 1846, FIEBER, 1851 (nomen nudum).
„ *meridionalis* COSTA, 1860.
„ *Scholtzi* FIEBER, 1861.

Micronecta meridionalis HORVÁTH, 1899.
,, *brachynota* HORVÁTH, 1899.
,, *semilaevis* HORVÁTH, 1899.
,, (*Dichaetonecta*) *scholtzi* HUTCHINSON, 1940.

The brachypterous form seen from above elliptical in outline [Textfig. 1]. The total length of Polish specimens

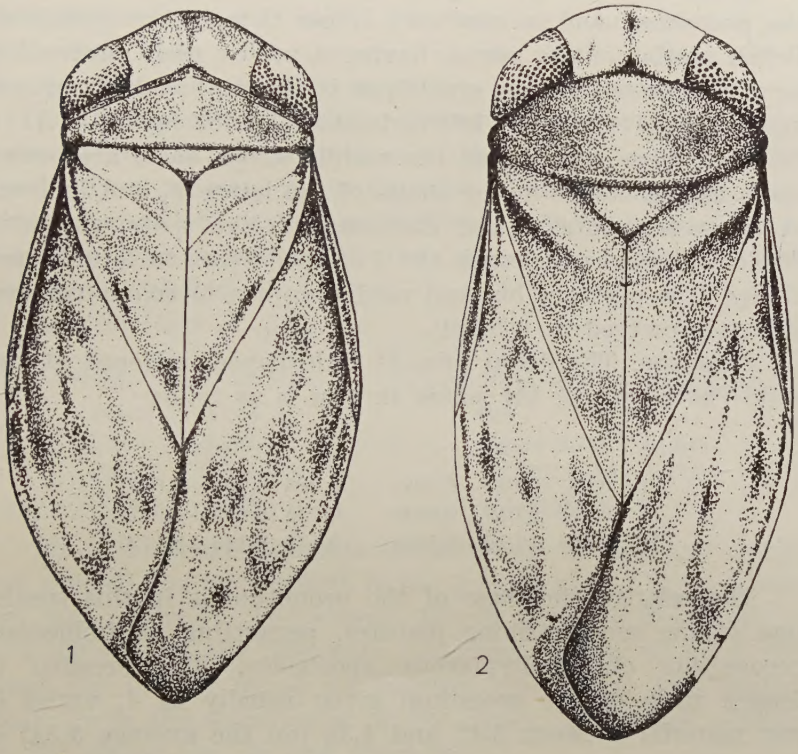

Fig. 1 and 2. *Micronecta meridionalis* (COSTA). 1. Brachypterous ♂ from W clay-pond at Poznań-Karolin, 7 VI 1953. 2. Macropterous ♀ from the lake at Zielonka, 19 VII 1953.

averages 2,3 (2,088—2,517) mm in the ♂♂ and 2,35 (2,145—2,545) mm in the ♀♀. Seasonal differences in size almost imperceptible, the more so as the individual variability is considerable. The ♂♂ of the spring generation are on the average 2,365 mm, the ♀♀ 2,367 mm long, in the summer generation the ♂♂ measure 2,27 mm, the ♀♀ 2,346 mm. The

breadth fluctuates between 1,12 and 1,34 mm, the ratio of the length to breadth being on the average 1,897 (1,773 – 2,051) in the ♂♂ and 1,878 (1,745 – 2,024) in the ♀♀. Thus although most specimens are relatively broader than in the other Polish species of *Micronecta* KIRK., there are found some as elongated as typical *M. minutissima* (L.).

The head is by 3,5 – 4 per cent of its breadth broader than the pronotum, and is relatively longer than in the remaining Polish species of the genus, having a vertex more protruding forward. The ratio of the synthlipsis to the eye-breadth averages in the ♂♂ 1,444 (1,314 – 1,625), in the ♀♀ 1,465 (1,263 – 1,714). On the vertex, apart from the middle stripe, there are brown spots near the eyes in the shape of the letter V, and in front of these are more or less distinct arch-like spots which in darker specimens join with the V-shaped spots to form closed circles. The eyes are big and reddish-brown in colour (in specimens preserved in alcohol).

Antennae. The distal joint is club-shaped, widened at the end. The length of the joints in mm is as follow:

	♂♂	♀♀[1]
I	0,09 (0,082 – 0,097)	0,088 (0,08 – 0,095)
II	0,055 (0,049 – 0,065)	0,056 (0,049 – 0,061)
III	0,164 (0,15 – 0,175)	0,172 (0,163 – 0,179)

The relative shortness of the pronotum is in this species one of the most striking features, permitting an immediate recognition of brachypterous specimens. The breadth to length ratio of the pronotum given usually as 4, varies in my material between 3,42 and 4,36 (on the average 3,84) in the ♂♂ and between 3,66 and 4,13 (on the average 3,85) in the ♀♀. In about 30 per cent of the specimens its value attains or exceeds 4. It seems rather improbable that this ratio should be 5 in English specimens of *M. meridionalis* (COSTA) as indicated by WALTON (1938). Anterior margin of the pronotum more convex, the tubercle in its centre scarcely visible.

Hemielytra narrowing distally, their outline therefore becoming wedge-like. Their surface shiny and with a pubescence

[1] 23 ♂♂ and 6 ♀♀ measured.

more uniformly scattered and longer than in any other of our species. The dark pattern is more primitive in *M. meridionalis* (Costa) (see p. 345). There are four stripes running along the corium, more or less distinct, which partly join at their ends. They disappear here and there, in other places they become more marked, and when enlarging the adjacent ones fuse. On the clavus the stripes run along the suture and along the interior margin, in the middle they increase in breadth and join with each other. The intensity of the pigmentation varies, though I have never met completely pale specimens.

In this species the wings of the brachypterous form are more reduced in size than in any other Polish member of the genus. They scarcely reach the fifth abdominal tergite, their length being on the average 60,35 (55,14 — 66,03) per cent of the length of the hemielytra in the ♂♂ and 56,06 (51,33 — 61,26) per cent in the ♀♀.

Anterior legs of ♂♂[1].

Average length in mm		Length relatively to femur-length
Femur	0,328	100
Tibia	0,193	58,96 (55,81 — 64,09)
Pala	0,214	65,29 (58,89 — 70,73)
Claw	0,138	42,21 (36,84 — 47,47)

The femur-length amounts on the average to 14,5 (13,5 — 15,8) per cent of the body-length in the ♂♂ and to 15,1 (14,6 — 15,9) per cent in the ♀♀. The average length of the femur in the ♀♀ is 0,332 mm, of the tibio-pala 0,335 mm. In the shape of the front leg I have found no features peculiar to this species apart from the narrowness of the claws. The apical bristles of the tibiae are big and thorn-like.

Median legs:

Average length in mm			Length relatively to femur-length	
	♂♂	♀♀	♂♂	♀♀[1]
Femur	0,857	0,883	100	100
Tibia	0,293	0,302	34,82 (32,31 — 35,5)	34,23 (32,51 — 34,76)
Tarsus	0,412	0,429	48,08 (45,35 — 50,82)	48,56 (46,98 — 50,39)
Claws	0,335	0,338	39,04 (36,06 — 41,66)	38,32 (36,98 — 39,75)

[1] 23 ♂♂ and 6 ♀♀ measured.

The femur-length amounts on the average in the ♂♂ to 37,7 (35,8—39,5) per cent of the body-length and in the ♀♀ to 41,4 (40—43,3) per cent. Distinctive to this species is the relative shortness of the tibiae and the tarsi. The ratios given by WALTON (1938), namely (conversed) 100:32,26:46,77:39,35 agree with those recorded by myself in this case.

Posterior legs[1]:

Average length in mm			Length relatively to femur-length	
	♂♂	♀♀	♂♂	♀♀
Femur	0,584	0,606	100	100
Tibia	0,462	0,475	79,07 (75,01—82,75)	78,32 (76,47—79,53)
Tarsus I	0,49	0,509	83,86 (79,53—88,15)	84,01 (79,74—86,5)
Tarsus II	0,241	0,244	41,29 (39,53—44,66)	40,28 (38—41,68)
Claw	0,165	0,164	28,21 (25,59—31,33)	27,15 (25,59—27,89)

The femur-length averages in the ♂♂ 25,7 (24,8—27,2) per cent of the body-length, in the ♀♀ 28,4 (27,5—29,6) per cent. Characteristic of *M. meridionalis* (COSTA) is the relatively longer second joint of the tarsus.

Abdomen pale in both sexes, the orange-coloured testes shine through the basal sternites in the ♂♂. Lateral tongue of the fifth tergite (prestrigilar flap) in the ♂♂ broad and short, of rhombic outline [Pl. XXIII, fig. 7 and 8]. It is not pigmented, therefore not very remarkable. The free lobe of the eighth segment very characteristic, its distal margin being slanted and concave, the setigerous one longer than the other [Pl. XXIII, fig. 9—11]. Still more peculiar are the shapes of the parameres in the ♂♂. In the right one the free portion is arcuate and evenly narrow, the base greatly differs too. Its interior margin is obtusely bent in the place where in the „*minutissima*" - group may be seen a nose-like prominence [Pl. XXIII, fig. 1—5]. No less characteristic is the left paramere. Its style is narrow, twisted screw-like at the apex, covered with numerous conic tubercles, regularly scattered, diminishing in size towards the base. The basal lobe relatively small, turned upwards, on the opposite side of the base there is another ear-like lobe [Pl. XXIII, fig. 6].

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[1] 23 ♂♂ and 6 ♀♀ measured.

The macropterous form [Textfig. 2] differs by its larger size (when compared with the average brachypterous specimens) and a more elongated shape of the body, which is at the same time more parallel-sided [Textfig. 2]. In my material I have 4 ♂♂, showing total lengths: 2,43 mm, 2,46 mm and 2,49 mm (2 specimens). The only ♀ is 2,6 mm long. The length to breadth ratio is in the ♂♂ 2,07—2,26, in the ♀ 2,068. The head is more bowed, therefore seems to be shorter and the vertex less prominent than in the brachypterous form. There are in both forms no essential differences in the ratios of the synthlipsis to the eye-breadth which amounts in the ♂♂ on the average to 1,482 (1,444—1,555), in the ♀ to 1,474. The pronotum, which in the brachypterous form is narrower than the head, is here somewhat broader (by 3,4 per cent of the head-breadth). The breadth to length ratio of the pronotum is in the ♂♂ 2,837 (2,75—2,909) in the ♀ 2,833. The pronotum is distinctly convex while in the brachypterous specimens it is flat. Hemielytra more parallel-sided, the membranes being well developed. The hind wings reach to the end of the abdomen. The legs (2 ♂♂ prepared) do not differ in their dimensions from those of the brachypterous specimens.

Synonymical notes

Leaving aside the name *M. scholtzii* (Fieber) which is known to be a nomen nudum (Lundblad, 1928) I shall discuss *M. brachynota* Horv. at length. Its identity with *M. meridionalis* (Costa) has already been suggested by Poisson (1938), who, however, attributed to *M. brachynota* Horv. the value of a geographical (southern) subspecies. Tamanini (1948) regards it as a somewhat paler brachypterous form of *M. meridionalis* (Costa). Horváth's material from the Museum of Budapest includes 6 specimens (4 „types") determined by that author as *M. brachynota* Horv. It is quite obvious to me, that they belong simply to *M. meridionalis* (Costa). The fact that they have a lighter coloration (the dark pattern being in some scarcely visible) is of minor importance. Also the size, which is in Horváth's specimens somewhat below the average in *M. meridionalis* (Costa), is of little

significance, since even in the smallest it does not pass the lower limit of variation which I have noticed in this species. The most decisive fact is after all the identity of the parameres of the ♂♂, which I was able to state having examined a ♂ type.

The macropterous form of *M. meridionalis* (Costa) was described by Horváth (1899) as *M. semilaevis* Horv. Poisson (1938), who meant to give a more detailed description of *M. semilaevis* Horv., examined two Horváth's „types" kept in Paris and collected at Vendres near Béziers (S France), as well as 6 specimens of his own from Morocco. He noticed the resemblance of the parameres in the ♂♂ of *M. semilaevis* Horv. and of those of the „*meridionalis*" - group, but considering the differences in the shape of the pronotum (normal in every macropterous form) he does not state the identity of this species with *M. meridionalis* (Costa). He even regards it as belonging to another group of species. Strangely enough, Tamanini (1948), who studied the macropterous form of *M. meridionalis* (Costa) and knew Poisson's (1938) paper, also did not identify this form with *M. semilaevis* Horv. In Horváth's material from the Museum of Budapest there are two specimens labelled as types of *M. semilaevis* Horv.: a ♂ from St. Charles (Algeria) and a ♀ from Portugal (the name of the locality illegible). While the ♀ appears to be a typical macropterous specimen of *M. meridionalis* (Costa), the ♂ is a common brachypterous specimen of the same species. It is somewhat more elongated and its pronotum is relatively longer (breadth to length ratio being only 3,1) but the pronotum is narrower than the head. The wings of this ♂ are shortened and the hemielytra narrow distally. Neither of the parameres differs from those of *M. meridionalis* (Costa). Even Horváth himself confused this „species" with others. I have found in his material, among specimens determined as *M. perplexa* Horv., a typical macropterous ♀ of *M. meridionalis* (Costa) from Buj, Hungary. There is also another ♀ from Czikud, Hungary, mentioned by Horváth (1916) as wrongly determined by himself („Specimen hungaricum erronee denominatum re vera ad *M. perplexa* Horv. pertinet"). In my opinion, however, this specimen belongs to *M. pusilla* Horv.

Poisson (1938) thinks *M. semilaevis* Horv. to be a synonym of *M. laevissima* (Puton). Since the type of the last species is lost, Poisson infers only from the descriptions of Horváth (1899) confronting them with the „types" of *M. semilaevis* Horv. examined by him. Now I must state, that in Horváth's material from the Museum of Budapest I have found a specimen from Oudref (Tunis) labelled by Horváth as „typus" and determined by him as *M. laevissima* (Puton). This may be just the single specimen discovered by M. Valery Mayet and mentioned by Puton (1886) in his description (known to me only from Poisson's citation (1938, p. 104). Horváth (1899) writes in the introduction to his paper that with the exception of *M. foveifrons* (Thoms.) he knew all Palaearctic species of *Micronecta* Kirk. He surely must have had and examined all of them. It is probable, that he managed to get Puton's type of *M. laevissima* (Puton) and kept it in his material. This specimen is a macropterous ♀, exceptional by its hemielytra completely deprived of pubescence, and the dots on the corium scarcely visible (even under great enlargement). Other characters agree with those of the macropterous *M. meridionalis* (Costa). The length is 2,69 mm, breadth 1,287 mm, the synthlipsis to eye-breadth ratio is 1,436. The pronotum which is 2,93 times as wide as long, does not show anything remarkable in its shape. The coloration is extremely pale, the dark pattern almost imperceptible. Unfortunately the best proof by examination of the parameres is impossible, the specimen being a ♀. Considering the lack of pubescence as an important difference and also being not sure after all about the identity of the mentioned specimen with Puton's type, I must restrain myself for the present from confirming Poisson's (1938) supposition. Thus, the question of identity of *M. laevissima* (Puton) and *M. meridionalis* (Costa) has to remain open, at least for the time being.

It seems very probable that in future a few more synonyms will be added to the list. A superficial examination of such species as *M. solitaria* Horv., *M. biskrensis* Horv. or *M. maculosa* Horv. shows their great resemblance to *M. meridionalis* (Costa). These species, however, being African will be the subject of a special study, in which I intend too to clear up

the systematic position of *M. capitata* Horv. [supposed to be a brachypterous form of *M. pusilla* (Horv.)].

M. meridionalis (Costa) which is distinguished by many peculiar features, and by some in a very striking way, was separated by some authors as the representative of a group of species called the „*meridionalis*" - group opposed to the „*minutissima*" - group (Poisson, 1938, Walton, 1938). Hutchinson (1940) establishing subgenera within the genus *Micronecta* Kirk. takes *M. meridionalis* (Costa) as the type of the subgenus *Dichaetonecta* Hutch. While this distinction is fully deserved, the basis of it seems to me questionable. The name which infers two bristles standing on the seventh sternite (instead of 4 — 6 in other subgenera) is also misleading. Because of this criterion of division *M. meridionalis* (Costa) and *M. scutellaris* (Stål) are placed in different subgenera (the latter being even designated a subgeneric type for *Basilaeonecta* Hutch.), though other characters, in particular the parameres show that both species are closely allied.

List of finds

Province Poznań. Distr. Szamotuły: Samołęż Lake, 2 VII 1953, 36 ♂♂, 90 ♀♀, leg. W. Serafiński. Distr. Oborniki: Murowana Goślina, Raduszyn Lake, 26 VIII 1954, 10 ♂♂, 1 ♀. Głęboczek, the lake, 22 VII 1953, 2 ♂♂ macropterous. Zielonka, the lake, 19 VII 1953, 1 ♀ macropterous; 25 VII 1954, 2 ♂♂; 24 VIII 1954, 3 ♂♂, 5 ♀♀; 27 VI 1955, 1 ♂. Poznań: Kierskie Lake, 10 VI 1935, 1 ♂. Rusałka Lake, 23 VII 1954, 55 ♂♂, 59 ♀♀. Poznań-Karolin: W clay-pond, 4 VIII 1936, 15 ♂♂ (1 macropterous), 19 ♀♀. N clay-pond, 13 VIII 1953, 2 ♂♂, 4 ♀♀. S clay-pond (Kajta), 7 VI 1953, 43 ♂♂, 23 ♀♀; 7 VI 1954, 13 ♂♂, 5 ♀♀; 24 VII 1954, 7 ♂♂, 10 ♀♀, leg. K. Skarżyńska. E clay-pond, 29 V 1953, 68 ♂♂, 67 ♀♀; 23 VI 1953, 22 ♂♂, 55 ♀♀; 15 VII 1953, 84 ♂♂, 67 ♀♀; 13 VI 1953, 35 ♂♂, 32 ♀♀; 8 IX 1953, 1 ♂, 2 ♀♀; 28 V 1954, 14 ♂♂, 1 ♀; 7 VI 1954, 57 ♂♂, 68 ♀♀; 17 VI 1954, 25 ♂♂, 33 ♀♀; 2 VII 1954, 25 ♂♂, 22 ♀♀; 14 VII 1954, 36 ♂♂, 33 ♀♀; 24 VII 1954, 47 ♂♂, 34 ♀♀; 9 VIII 1954, 59 ♂♂, 51 ♀♀; 21 VIII 1954, 58 ♂♂, 32 ♀♀; 2 IX 1954, 45 ♂♂, 10 ♀♀; 10 IX 1954, 11 ♂♂, 4 ♀♀; 20 IX 1954, 6 ♂♂, 1 ♀; 6 VI 1955, 2 ♂♂. Poznań-Wilda, cut-off lake of Warta River, 2 VI 1935, 2 ♂♂, 1 ♀. Poznań-Górczynek: N (small) clay-pond, 11 VI 1953, 72 ♂♂, 53 ♀♀; 17 VIII 1954, 27 ♂♂, 22 ♀♀, leg. L. Berger. S (great) clay-pond, 11 VI 1953, 6 ♂♂, 16 ♀♀; 17 VIII 1954, 21 ♂♂, 6 ♀♀, leg. L. Berger. Distr. Poznań: Rosnówko, Małe Lake, 27 VII 1949, 2 ♂♂, 1 ♀. Jarosławieckie Lake, 4 VIII 1935, 13 ♂♂, 7 ♀♀; 27 VII 1949, 14 ♂♂, 12 ♀♀; 2 VI 1953, 25 ♂♂, 29 ♀♀, leg. J. Jaskowska. Distr. Śrem:

Niwka, cut-off lake of Warta River, 5 VII 1936, 2 ♂♂, leg. L. Kruś. Sowiniec, Warta River, the mouth of a brook, 30 VI 1953, 1 ♂ macropterous. Gądki, clay-pond, 5 VI 1953, 1♂, 5 ♀♀, leg. J. Jaskowska; 19 VIII 1953, 14 ♂♂, 19 ♀♀, leg. E. Smoleńska; 5 VI 1954, 3 ♂♂, 1 ♀, leg. J. Jaskowska. Distr. Krotoszyn: Kobierno, clay-pond, 17 VI 1955, 41 ♂♂, 40 ♀♀, leg. L. Berger. Zduny, clay-pond, 20 VII 1955, 24 ♂♂, 9 ♀♀, leg. L. Berger. Distr. Rawicz: Grąbkowo, 23 VI 1955, 6 ♂♂, 6 ♀♀, leg. L. Berger. Ostrzeszów: clay-pond, 28 VI 1955, 14 ♂♂, 14 ♀♀, leg. L. Berger. Distr. Kępno: Doruchów, mill-pond, 28 VI 1955, 11 ♂♂, 16 ♀♀, leg. L. Berger; clay-pond, 28 VI 1955, 13 ♂♂, 13 ♀♀, leg. L. Berger.

Province Wrocław. Distr. Milicz: Stawiec, clay-pond, 23 VI 1955, 43 ♂♂, 24 ♀♀, leg. L. Berger.

Ecology

As it can be seen from the preceeding list all my material of *M. meridionalis* (Costa) amounts to 1140 ♂♂ (4 macropterous) and 1023 ♀♀ (1 macropterous). They were collected in 52 samples at 25 habitats. *M. meridionalis* (Costa) is in our country an inhabitant of stagnant waters, preferring mainly moderately deep (2 — 5 m) water bodies which get warm easily. Among its habitats there are lakes (8), mostly small and rather shallow ones. Kierskie Lake, which is larger and deeper (35 m) proved to be unfavourable, since the species found there on 10 VI 1935 (a brachypterous ♂ and therefore autochthonous) did not multiply and completely disappeared there. Most frequent among the habitats are clay-ponds (13), formed in old clay-pits filled with water. The older and deeper of them resemble often lakes in many ways. One of them, the E clay-pond at Poznań-Karolin is described in details on p. 351—353. *M. meridionalis* (Costa) also occurs in some cut-off lakes of the river Warta (4) and was found once in a mill-pond.

At 7 habitats *M. meridionalis* (Costa) was the only species of the genus, at all the remaining ones it occurred together with other species of *Micronecta* Kirk. Its most regular companion was *M. minutissima* (L.) which at 6 habitats was also the only companion. *M. meridionalis* (Costa) either predominated or was at least equally abundant. At 6 habitats *M. meridionalis* (Costa) was associated with two species, the second being *M. griseola* Horv. In another 6 cases *M. gri-*

seola Horv. was the only species sharing the habitat, finally in the E clay-pond at Karolin *M. meridionalis* (Costa) dominates over three species, with *M. poweri* (Dgl. Sc.) as the third.

Since the majority of the habitats are isolated, their colonizing must have been done by macropterous specimens — able to fly. Here a proof may be the case of the Zielonka Lake. Until July, 1953, there occurred only *M. minutissima* (L.) and *M. griseola* Horv. It was on July 19, 1953, when for the first time I noticed the presence of *M. meridionalis* (Costa) in this lake, catching a macropterous ♀. In July, 1954, there were already some brachypterous specimens of this species, and in August, 1954, *M. meridionalis* (Costa) was quite numerous there. The macropterous ♀ came possibly from the rather remote (over 8 km) Raduszyn Lake, the nearest habitat of this species found in the neighbourhood. Two macropterous ♂♂ found at the same time in Głęboczek Lake (2 km from Zielonka) probably came from the same source. Also the macropterous ♂ from Sowiniec should be regarded as a migratory, since it was caught as the only representative of the species at the habitat. Only the ♂ from the W clay-pond at Poznań-Karolin may be considered as autochthonous because it was caught together with numerous brachypterous specimens of *M. meridionalis* (Costa).

Development

Poisson's (1935) account on this subject is of great value, although it is neither complete nor detailed enough. My observations, treated as a secondary task leave also many points unexplained. The observations were made in the E clay-pond at Poznań-Karolin (see p. 351—353), then also partly in laboratory breeding and lastly in a small artificial pool in the open. My observations in the clay-pond were rendered possible by the fact, that the larvae, even the youngest ones, are easy to distinguish. The light heartshaped stain on their metanota bordered by a brown girdle [Textfig. 4—8] is much larger than in all our species of the „*minutissima*" - group, which have it narrowed and much reduced by a broader dark girdle.

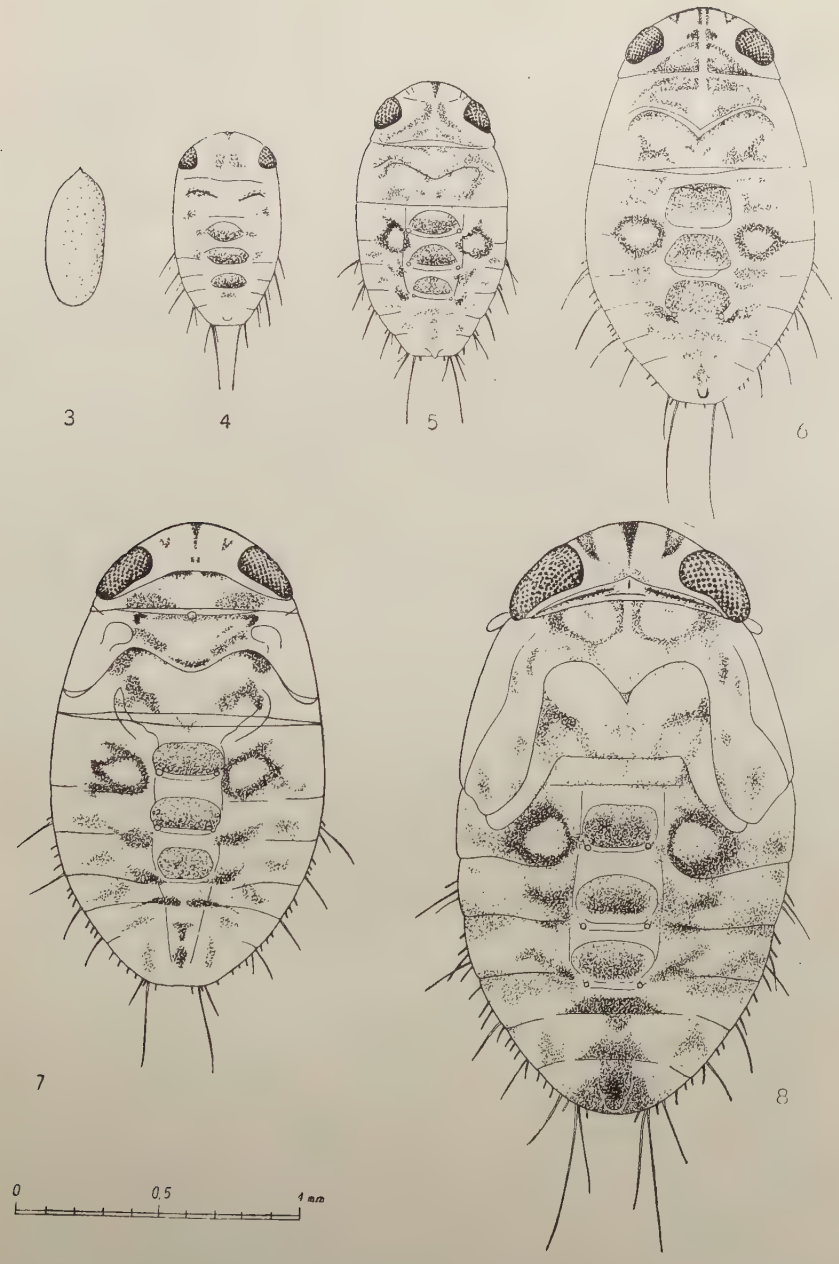


Fig. 3—8. *Micronecta meridionalis* (Costa). 3. Egg. 4. Larva of the I stage. 5. Larva of the II stage. 6. Larva of the III stage 7. Larva of the IV stage. 8. Nymph (V stage).

This species hibernates, as do also other Polish species of *Micronecta* KIRK., mainly (if not exclusively) as larvae of the fourth stage. In 1954 all larvae of *M. meridionalis* (COSTA) collected in the E clay-pond from March 28 (the first catch from under the ice) till May 14 were in this stage. Up to the end of April they remained in the deeper littoral (0,5—1 m deep) and about May 5, when the temperature of the surface-water rose to 16° C, they came to the shallowest water at the edge. The first nymphae (fifth stage) I have found on May 14, they formed 25—40 per cent of all the larvae of this species, taken on that date. This percentage increased in every later catch till May 20, when I caught but one larva of the fourth stage among 74 nymphs. The earliest brim-approaching larvae are ♂♂, easily recognizable in *M. meridionalis* (COSTA) by their testes shining through.

Imagines must have appeared in 1954 about May 25, because on May 28 I have already found a great number of them and a ♀ too. As in all our other species of the genus the ♂♂ become adult some 2—3 days earlier than the ♀♀. *M. meridionalis* (COSTA) ends the development of its overwintering generation as the last of the four species of the genus inhabiting the investigated clay-pond. *M. poweri* (DGL. SC.) preceeded it in 1954 by about 11 days, the other species, *M. griseola* HORV. and *M. minutissima* (L.) by some 5 days. In 1955 the corresponding differences in the dates of appearance amounted to 15 and 10 days.

In Poland *M. meridionalis* (COSTA) has at least two generations during the year. In 1954 the first adult members of the second, i. e. the summer generation, were found in the E clay-pond on July 14. They were but few, all fresh, just after the last ecdysis and occurred with numerous nymphs much advanced in development. Many specimens of the spring generation were still with them. At the same time in this pond were found larvae in all possible stages, the younger ones in a greater depth by the shore (0,5—1 m), the older ones (fourth and fifth stage) in shallow water.

In the same pond I also found freshly metamorphosed imagines of *M. meridionalis* (COSTA) in August (9 and 21 VIII) and in September (10 IX 1954). They may have been the

latest members of the summer generation, hatched from the last eggs laid by the spring ♀♀ in July, but it appears also possible that the specimens freshly metamorphosed in September represented a third generation developed from the first eggs laid by the summer generation, about the middle of July. In the second half of August the number of the ♀♀ decreases and the ♂♂ become more prevailing in the samples. The last imagines in the E clay-pond were collected on September 20, 1954. In October (10 X) I have noticed there only larvae, mostly of the fourth stage, and some still of the third. A catch was then made at a depth of 0,7 m.

I have also made a number of observations when breeding this species in a small concrete basin (3 m long, 1 m wide, 0,3 m deep) having flat banks and on the bottom a thin layer of sandy mud brought from a lake. On June 6, 1955 I have put there over 150 adults of *M. minutissima* (L.), 60 of *M. griseola* HORV. and 80 nymphs (fifth stage) of *M. meridionalis* (COSTA). All the members of the first two species died soon while many of the nymphs of *M. meridionalis* (COSTA) survived, passed the last ecdysis and gave the second generation. Its first imagines must have finished the development at the beginning of August, since in the catch of July 26 I found numerous nymphs (fifth stage) much advanced in development as well as a few remnants (only ♂♂) of the spring generation; on the other hand, on August 16 the imagines, both ♂♂ and ♀♀, were quite abundant (some pairs copulating), the nymphs being but few. The first larvae of the overwintering generation (first stage) were caught in this basin on August 26. Transferred to a Petri dish and there bred (two specimens) in the laboratory they underwent the first ecdysis on August 29, the second on September 6 and the third on September 21 (one specimen) and on September 26 (the second specimen); then the development stopped. In the fourth stage the larvae remained unchanged till November 15, when the breeding experiment was given up. In the open-air basin in September I noticed the beginning of a decline in the population. The last adult specimens (2 ♂♂, 1 ♀) I observed on September 10. At the same time I found larvae in the third and fourth stage. The final examination on September 22 showed only the pre-

sence of larvae in the same stages, the fourth prevailing, with a single larva of the second stage. The whole development lasted 7—8 weeks as in the E clay-pond, and the larvae that had to pass the winter similarly attained mostly the fourth stage.

In breeding *M. meridionalis* (Costa) proved to endure best (of our species) the low content of oxygen, the quantity of which must have been often very low in the quickly warming water of the basin. In any case it was insufficient for the two other species of *Micronecta* Kirk. This experiment showed also the possibility of the development of *M. meridionalis* (Costa) in shallow waters, although it was apparently limited, the larvae of the second generation being scarce.

Size of the larvae:

Stage	Length in mm	Breadth in mm
I	0,672 (0,629—0,686)	0,352 (0,343—0,372)
II	0,915 (0,858—0,972)	0,512 (0,458—0,572)
III	1,265 (1,173—1,375)	0,718 (0,686—0,772)
IV	1,705 (1,573—1,83)	0,982 (0,915—1,058)
V	2,115 (2,002—2,202)	1,2 (1,087—1,258)

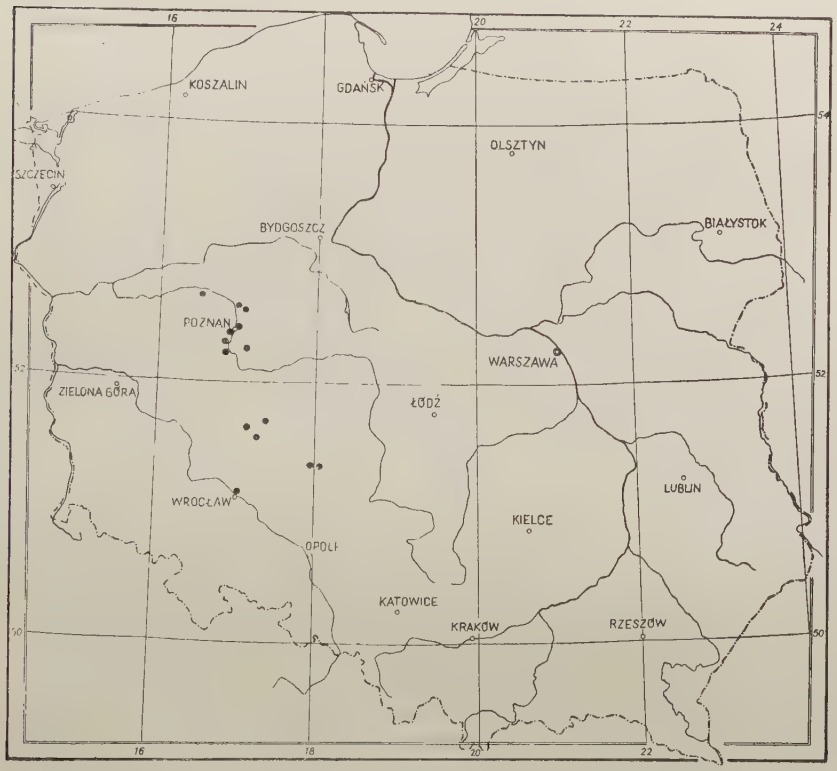
Just after every ecdysis the larvae are extremely flat and relatively broad. Later they become thicker, narrower and more elongated.

Geographical distribution

The map illustrating the scattering of Polish habitats [Map 1] shows them as mostly situated in the Province of Poznań, the most northern of them being the Samołęż Lake, the most southern a clay-pond near Kępno.

The latter is not too remote from the Silesian habitats of *M. meridionalis* (Costa), for example from Wrocław, the first known in general (Scholz, 1846) habitat of this species. Undoubtedly it will be found in future in further localities in Great Poland and in the Silesia Lowlands. The occurrence of this species in other parts of our country can not definitely be expected. It seems probable that *M. meridionalis* (Costa) first came to Silesia from the south through the Moravian Pass and this happened not so long ago, perhaps it has not

succeeded too far in its progress in the northern and eastern directions. In any case the habitats in the southern part of Great Poland are more numerous and more widely scattered. The lack of suitable waters is, in my opinion, mainly checking the expansion of this species, the climatic factors seem to be



Map 1. Polish stations of *M. meridionalis* (COSTA).

of less importance. As *M. meridionalis* (COSTA) is confined to live in stagnant waters only and apparently avoids running waters, it is very limited in its possibilities of migration and also in extending of its area. As I have said above, macropterous specimens are most probably the pioneers who take possession of new habitats. Nevertheless, rivers too seem to have some share in the propagation of this species. The localisation of the habitats obviously suggests it. A great part of them lay in the

vicinity of the Warta River as I have previously noticed (Wróblewski, 1939 a) which I can now confirm. *M. meridionalis* (Costa) avoids the rivers themselves but occurs in their by-waters, as e. g. cut-off lakes. It may be that during floods, the high-water of the river inundating such habitats transfers a part of the specimens and they settle in by-waters situated in the valley down-stream, thus spreading the extent of the area along the river course.

According to published records *M. meridionalis* (Costa) is widely distributed all over southern Europe from Spain to the Caucasus. It occurs in England but not in Denmark nor in Scandinavia. In Germany it is known from Thuringia, in the USSR from the Ukraine, the Crimea and the Caucasus. Its area of distribution extends also to Africa, including Morocco, Algeria and Tunis. As I have mentioned above, there remains still to be cleared up the systematic validity of some species closely related to *M. meridionalis* (Costa), especially of *M. pusilla* Horv. (= *M. capitata* Horv.). *M. pusilla* Horv. seems to be only an eastern form (subspecies?) of *M. meridionalis* (Costa) differring chiefly by its more protruding vertex. It is quite probable that the records from eastern Europe, at least a part of them, refer to the above mentioned form.

2. *Micronecta minutissima* (Linnaeus)

Notonecta minutissima Linnaeus, 1758.
? *Sigara minuta* Fabricius, 1794.
„ *foveifrons* Thomson, 1871.
Micronecta minutissima Kirkaldy, 1897; Lundblad, 1928, 1936; Walton, 1938; Wróblewski, 1939 a (ex parte), 1952 (ex parte).
„ *rugicollis* Horváth, 1901.
„ *wagneri* Linnavuori, 1951; Wagner, 1952.

Brachypterous form of elliptical outline [Textfig. 9]. The average length of my specimens is in the ♂♂ 2,021 (1,773—2,228) mm, in the ♀♀ 2,041 (1,802—2,345) mm. Sexual dimorphism, as regards size, is hardly visible, the seasonal dimorphism, however, is considerable. The average length of the spring generation is 2,121 mm in the ♂♂ and 2,144 mm in the ♀♀. The summer generation is smaller, its ♂♂ are on the

average 1,954 mm and the ♀♀ 1,994 mm long. The participation of both generations in different length-classes is shown in the following table:

Generation	♂♂		♀♀	
Months	Spring V—VI	Summer VII—IX	Spring V—VI	Summer VII—IX
1,75—1,8 mm	—	5	—	1
1,8 —1,85 „	—	9	—	3
1,85—1,9 „	1	49	—	19
1,9 —1,95 „	6	79	1	45
1,95—2 „	9	72	5	51
2 —2,05 „	8	21	6	18
2,05—2,1 „	36	16	12	25
2,1 —2,15 „	59	6	23	12
2,15—2,2 „	42	2	19	6
2,2 —2,25 „	8	—	9	2
2,25—2,3 „	5	—	6	—
2,3 —2,35 „	—	—	2	—

Maximal frequencies, in accordance with the averages given above for the generations, fall in the spring generation in the 2,1—2,15 mm class (for both sexes), in the summer generation in the 1,9—2 mm classes for the ♂♂ and in the 1,95—2 mm class for the ♀♀. The variation-curve of the length, if both generations' members were considered together, would have two summits, showing the double character of the population.

The breadth fluctuates between 0,829 and 1,173 mm. The body is on the average 2,058 (1,857—2,303) times as long as it is wide in the ♂♂ and 2,069 (1,892—2,242) times in the ♀♀; *M. minutissima* (L.) is thus the most elongated of all our species of the genus.

Head seen from above, especially in the middle, somewhat longer than in our other species of the „*minutissima*" - group. The average synthlipsis to eye-breadth ratio is in the ♂♂ 1,46 (1,176—1,692), in the ♀♀ 1,474 (1,176—1,714). It is very characteristic for *M. minutissima* (L.) and permits to distinguish this species from *M. griseola* HORV. at a glance. LINNAVUORI (1951) has already stressed this. He indicates this proportion as 1,55 which is higher than my average, while

Wagner (1952) limits it to 1,3—1,4, which is lowered. The variation, however, is rather wide and therefore the numbers noticed by both these authors may be correct for their sets of specimens. Head-breadth in the ♂♂ 0,711 (0,63—0,83) mm, in the ♀♀ 0,735 (0,66—0,83), it is always less than the pronotum-

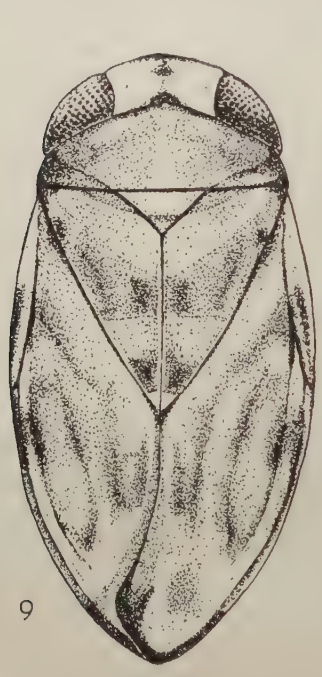


Fig. 9 and 10. *Micronecta minutissima* (L.). 9. Brachypterous ♀ from Uzarzewskie Lake, 16 VI 1954. 10. Macropterous ♀ from Rusałka Lake, 23 VII 1954.

breadth, which seems to be a rule for all species of this group (subgenus *Micronecta* s. str. Kirkaldy). The eyes are larger and usualy of a cherry-red tint (in specimens preserved in alcohol). Antennae showing no constant and remarkable differences when compared with those of *M. griseola* Horv. in spite of Linnavuori's (1951, fig. 2D) and Wagner's (1952, fig. 40) figures.

Length of joints in mm[1]:

	♂♂	♀♀
I	0,081 (0,068—0,099)	0,081 (0,072—0,086)
II	0,049 (0,04—0,059)	0,052 (0,042—0,057)
III	0,149 (0,129—0,167)	0,158 (0,148—0,171)

The pronotum is in *M. minutissima* (L.) flatter than in other species, the tubercle in the middle of the anterior margin is more distinct and from it starts a short keel. Posterior margin usually less convex, though never so as in LINNAVUORI's (1951) fig. 1, where it is nearly straight. The pronotum-length, depending upon size of the specimens, is on the average 0,255 (0,228—0,283) mm in both sexes. Pronotum in the ♂♂ 2,85 (2,67—3,1) times as wide as long and in the ♀♀ 2,864 (2,72—3,02) times. This ratio greatly resembles that of *M. griseola* HORV.

Fig. 11. Right hemielytron of a ♂ *Micronecta minutissima* (L.) from Strzeleckie Lake (Chodzież), 6 VII 1953.

Hemielytra nearly parallel-sided. Their pubescence, in a manner common to the members of the „*minutissima*"- group, consists of very short hairs not scattered uniformly. The hemielytra of *M. minutissima* (L.) are most often transparent, the larval dorsal glands shining through them quite distinctly. Their dark pattern resembles *M. meridionalis* (COSTA), with four stripes running along the corium. Although fading in part, all of them are discernible, especially in specimens from waters with a dark bottom. On the other hand, in specimens living on a light coloured bottom the pattern is reduced to terminal and middle-fragments, having the shape of oblong streaks more or less pale and sometimes disappearing completely.

In the coloration of the hemielytra of *M. minutissima* (L.) I have found a phenomenon unnoticed till now, and occurring only in this of our species. Among specimens living on a dark or overgrown bottom I have often observed a certain per cent with the anterior (basal) half of the corium uniformly dark

[1] 91 ♂♂ and 8 ♀♀ measured.

[Textfig. 11]. At most a stripe along the claval suture was paler. This darkening is evidently the result of an enlargement of the basal parts of the stripes and of their confluence. On the distal part of the corium the stripes remain unchanged. In the samples containing such specimens there are most often some transitional ones in which only the basal corner of the corium is uniformly dark.

The wings of the brachypterous form as a rule reach the middle of the seventh abdominal tergite, but quite often they extend to its posterior margin. Their length is on the average 76,12 (68,75—80,3) per cent of the length of the hemielytra in the ♂♂ and 73,68 (69,23—76,8) in the ♀♀. Thus the wings in this species (and in this form) are apparently of larger size than in all other Polish members of *Micronecta* Kirk.

Anterior legs of the ♂♂[1]:

Average length in mm		Length relatively to femur-length
Femur	0,313	100
Tibia	0,182	58,14 (53,09—64,63)
Pala	0,214	68,16 (62,63—74,36)
Claw	0,123	39,17 (32,5—46,15)

The femur-length averages 15,24 (13,91—16,32) per cent of the body-length in the ♂♂ and 13,65 (12,66—14,5) in the ♀♀. The dimensions recorded by Lundblad (1936) are not typical. The femur- and tibia-lengths stated by him agree with my highest extremes and the pala-length matches my average. The shape of the pala shows in *M. minutissima* (L.) no peculiar features. In spite of Linnavuori's (1951) statement the pala of this species, when compared with that at *M. griseola* Horv., is neither bigger nor broader. The average length of the femur in the ♀♀ is 0,283 mm, of the tibio-pala 0,302 mm.

Median legs[1]:

Average length in mm			Length relatively to femur-length	
	♂♂	♀♀	♂♂	♀♀
Femur	0,762	0,769	100	100
Tibia	0,273	0,274	35,83 (33,87—38,28)	35,62 (34,03—37,29)
Tarsus	0,419	0,42	55,06 (51,35—58,62)	54,66 (51—55,7)
Claw	0,283	0,267	37,18 (32,12—42,77)	34,7 (31,27—38,65)

[1] 91 ♂♂ and 8 ♀♀ measured.

The femur-length averages in the ♂♂ 37,13 (34,48—39,09) per cent, in the ♀♀ 37,31 (35,75—38,03) per cent of the body-length. Walton's (1938) ratios, perhaps too simplified, do not agree with mine at all. The tarsus is on the average 1,488 (1,364—1,657) times as long as the claws in the ♂♂ and 1,577 (1,42—1,732) in the ♀♀. This ratio is approximately the same as in *M. griseola* Horv. It can not be therefore of any use in separating these two species. Wagner (1952) determining the value of this ratio for this species as 1,4—1,55 is correct enough, but his value for *M. griseola* Horv.: 1,7—1,9 is much too high. The relative shortness of the tibia may be regarded as specific for *M. minutissima* (L.). It is so short only in *M. meridionalis* (Costa).

Posterior legs[1]:

Average length in mm			Length relatively to femur-length	
	♂♂	♀♀	♂♂	♀♀
Femur	0,515	0,523	100	100
Tibia	0,414	0,42	80,16 (73,68—85,39)	80,24 (75,77—83,27)
Tarsus I	0,438	0,44	84,68 (78,61—90,66)	84,01 (78,84—87,45)
Tarsus II	0,19	0,186	36,73 (32,69—40,29)	35,53 (34,67—37,97)
Claw	0,14	0,138	27,14 (23,94—31,15)	26,35 (24,16—28,92)

The femur-length amounts on the average to 25 (23,4—26,3) per cent of the body-length in the ♂♂ and 25,3 (24,5—26,3) per cent in the ♀♀. Walton's ratio though inexact, may be included within the limits of variation observed by me. The first joint of the tarsus is relatively longer than in other species [and again like in *M. meridionalis* (Costa)].

The abdomen is pale in both sexes, rarely and only in very dark specimens the fourth and fifth sternites of the ♂♂ are darkened, though never black. The lateral tongue of the fifth tergite (prestrigilar flap) of the ♂♂ [Pl. XXIV, fig. 22—24] has its tip characteristically rounded, though the outline is variable. Also varying is the outline of the eighth segment's free lobe [Pl. XXIV, fig. 25, 26]. The posterior margin of the lobe is quite often more straight than in the other species, but this can be hardly called a rule. Most reliable are the shapes of the para-

[1] 91 ♂♂ and 8 ♀♀ measured.

meres of the ♂♂, though a resemblance to *M. griseola* Horv. in them is obvious. The free portion of the right paramere [Pl. XXIV, fig. 12—15] is somewhat broader than in *M. griseola* Horv., on its concave margin there is always a distinct angle, the end is more prolonged. I have never met a hooked tip as figured by Wagner (1952, fig. 20). Such form of this paramere as shown by Lundblad (1928) is also not correct, a far better one is in another paper of Lundblad (1936, fig. M). Linnavuori (1951) confuses the right parameres of both species not only in his illustrations but also in the text. The left paramere [Pl. XXIV, fig. 16—21] is characterised mainly by its tip. The margins of the free portion are more regularly bent, the convex one passing to the apex by a larger, more moderate curve, turning slightly back at the tip. There is at the apex no saddle-like incision peculiar to *M. griseola* Horv.

The macropterous form [Textfig. 10] is distinguished by all attributes attached to such a form, no matter which species of *Micronecta* Kirk. is concerned (at any rate among Polish species). In my material I have 7 ♂♂, whose average length is 2,227 (2,14—2,35) mm and 36 ♀♀ on the average 2,243 (2—2,49) mm long. The seasonal variation in size is evident, the biggest specimens belonging to the spring generation (May). The length to breadth ratio of the body is 2,181 (2,139—2,229) in the ♂♂, and 2,137 (1,973—2,333) in the ♀♀, and thus the macropterous specimens of *M. minutissima* (L.) are on the average less elongated than such specimens of *M. griseola* Horv. (it is the reverse in the brachypterous forms of these two species). The head, seen from above, has a delusive appearance of being shorter than in the brachypterous form. The synthlipsis to eye-breadth ratio in the ♂♂ 1,487 (1,333—1,571), in the ♀♀ 1,483 (1,371—1,704), does not differ from that of the brachypterous form. Pronotum broader than the head by about 13 per cent of the head-breadth. The breadth to length ratio of the pronotum is in the ♂♂ 2,555 (2,417—2,762), in the ♀♀ 2,59 (2,4—2,947), its value surpasses thus that of the macropterous forms of all other Polish species, with the exception of *M. meridionalis* (Costa). Hemielytra parallel-sided, the membranes being fully developed. Other characters alike in both forms.

Synonymical notes

M. minutissima (L.) is the most often confused of our species. There is no wonder; it differs from *M. griseola* Horv. in many characters, but mostly not very strikingly, sometimes scarcely perceptibly to the inexperienced eye. Usually having both species in a sample makes the identification easier; then the examination of the male parameres clears any doubts whatever.

Of many authors who have written on *M. minutissima* (L.), Walton (1938) was the only one who has really dealt with this species, i. e. with that one, which Lundblad (1928) having described it exactly enough, proposed to regard as the Linnaean species. This is quite evident from the figures of the parameres in Walton's paper. All other records concerning *M. minutissima* (L.) are incorrect or at least doubtful.

The first synonym — *M. foveifrons* (Thomson) I mention following Lundblad (1928). The types being ♀♀, and badly preserved too, the identity is not absolutely sure, but seems probable.

As to *M. rugicollis* Horv. I can now confirm the statements of Lindberg (1924) and of Lundblad (1928), as I have examined specimens determined by Horváth and have made a preparation of one of them.

The last synonym — *M. wagneri* Linnavuori has been previously discussed (see p. 254). At any rate it is Linnavuori's undeniable merit that he first distinguished both species, although he wrongly identified them and confused their parameres.

M. minutissima (L.) is our only species the macropterous form of which was not described as a different species. The cause is certainly the rareness of this form and probably the limited distribution of this species.

List of finds

Province Szczecin. Distr. Wolin: Wisełka Lake, 29 VI 1948, 2 ♂♂, 3 ♀♀. Kołczewo, Racze Lake, 29 VI 1948, 12 ♂♂, 3 ♀♀. Dąbie Szczecińskie: Dąb Lake, 11 VIII 1953, 12 ♂♂, 9 ♀♀. Płona River, 11 VIII 1953, 1 ♂. Distr. Pyrzyce: Będzin Lake, 12 VI 1954, 33 ♂♂, 10 ♀♀. Choszczno:

Klukom Lake, 11 VI 1954, 30 ♂♂, 7 ♀♀. Myślibórz: Myśla Rivulet 12 VI 1954, 8 ♂♂, 1 ♀. Myśliborskie Lake, 12 VI 1954, 80 ♂♂, 26 ♀♀, Jezierzyce Lake, 12 VI 1954, 7 ♂♂, 1 ♀.

Province Koszalin. Distr. Białogard: Połczyn, pond, 26 V 1949, 1 ♀. Buślary, the lake, 26 V 1949, 6 ♂♂. Distr. Szczecinek: Wielimie Lake, 4 VI 1954, 17 ♂♂, 6 ♀♀. Distr. Drawsko: Bobrowo, Wąsosze Lake, 5 VI 1954, 50 ♂♂, 11 ♀♀.

Province Bydgoszcz. Distr. Chojnice: the lake E from Swornegacie, 3 VI 1954, 12 ♂♂. Swornegacie, the lake in the forest, 3 VI 1954, 9 ♂♂. Distr. Bydgoszcz: Wiązewno, Błonawka pond, 18 VIII 1938, 3 ♀♀. Distr. Brodnica: Partęczyny Lake, 16 VIII 1953, 4 ♂♂, 1 ♀. Zbiczno Lake, 16 VIII 1953, 4 ♂♂, 2 ♀♀. Niskie Brodno Lake, 17 VIII 1953, 14 ♂♂, 3 ♀♀. Brodnica, clay-pond „Morskie Oko", 17 VIII 1953, 27 ♂♂, 23 ♀♀. Żnin: Małe Lake, 11 VIII 1953, 4 ♂♂, 1 ♀ (T)[1]. Wielkie Lake, 11 VIII 1953, 1 ♀ (T). Distr. Mogilno: Popielewskie Lake, 26 VI 1955, 4 ♂♂, 1 ♀. Gopło Lake, 4 VIII 1953, 71 ♂♂, 24 ♀♀.

Province Olsztyn. Iława: Jeziorak Lake, 15 VIII 1953, 3 ♂♂, 1 ♀. Distr. Morąg: Małdyty Lake, 10 VIII 1949, 3 ♂♂, 3 ♀♀. Olsztyn: Długie Lake, 11 VIII 1949, 15 ♂♂, 4 ♀♀. Krzywe Lake, 25 VIII 1953, 6 ♂♂, 12 ♀♀. Olsztyn-Kortowo: Żabinek Lake, 22 VIII 1953, 1 ♀. Little lake, 24 VIII 1953, 4 ♂♂, 1 ♀. Szczytno: the lake in the forest, 18 VIII 1949, 1 ♂, 1 ♀. Distr. Mrągowo: Krutynia River upstream from Ukta, 17 VIII 1953, 2 ♂♂, 2 ♀♀ (J). Mikołajki Lake, 20 VI 1954, 3 ♂♂ leg. S. Kosicki.

Province Białystok. Distr. Knyszyn: Czechowskie Lake, 28 VII 1954, 2 ♂♂, 1 ♀.

Province Zielona Góra. Distr. Międzyrzecz: Chycińskie Lake, 7 VIII 1947, 10 ♂♂, 1 ♀. Distr. Sulęcin: Łagów, Trzęśniowskie Lake, 18 VII 1954, 8 ♂♂, 10 ♀♀, leg. M. Urbańska. Distr. Sulechów: Pomorsko, cut-off lake of Odra River, 9 VIII 1947, 3 ♂♂, 6 ♀♀. Distr. Głogów: Konotop, Świętno Lake, 29 VIII 1953, 9 ♂♂, 4 ♀♀. Sławskie Lake, 29 VII 1953, 39 ♂♂, 12 ♀♀ (T).

Province Poznań. Distr. Chodzież: Strzeleckie Lake, 6 VII 1953, 108 ♂♂, 7 ♀♀ (J). Miejskie Lake, 6 VII 1953, 45 ♂♂, 18 ♀♀ (J). Distr. Międzychód: Tuczno Lake, 15 VII 1954, 2 ♂♂ (S). Gorzyńskie Lake, 15 VII 1954, 1 ♂, 1 ♀ macropterous (S). Miejskie Lake, 14 VII 1954, 1 ♂ (S). Bielskie Lake, 16 VII 1954, 3 ♂♂ (S). Lubiwieckie Lake, 16 VII 1954, 1 ♂ (S). Jaroszewskie Lake, 28 VIII 1953, 1 ♂, leg. J. Mirek. Sieraków, Lutomskie Lake, 28 VIII 1953, 1 ♂, 1 ♀, leg. J. Mirek. Mylin, Radziszewskie Lake, 7 VIII 1953, 12 ♂♂, 5 ♀♀. Wielkie Lake, 7 VIII 1953, 20 ♂♂, 4 ♀♀. Chrzypskie Lake, 7 VIII 1953, 14 ♂♂, 7 ♀♀. Śródka, Kuchenne Lake, 7 VIII 1953, 14 ♂♂, 9 ♀♀. Distr. Szamotuły: Pniewy Lake, 29 VII 1955, 2 ♂♂, 4 ♀♀, leg. A. Kasprowicz. Mormin Lake,

[1] (J) means: leg. J. Jaskowska, (S) — leg. E. Smoleńska, (T) — leg. A. Tschuschke.

16 VI 1953, 2 ♂♂, 6 ♀♀; 22 V 1954, 104 ♂♂, 4 ♀♀. Ostroróg, Wielkie Lake, 16 VI 1953, 1 ♂; 22 V 1954, 35 ♂♂, 5 ♀♀. Bytyńskie Lake, 28 VIII 1953, 3 ♀♀ (S). Distr. Oborniki: Rogoźno, Rogoźno Lake, 1 VIII 1954, 8 ♂♂, 6 ♀♀, leg. Z. Pniewski. Sławica, the rivulet, 3 ♂♂, 6 ♀♀. Głębocko, the brook, 25 VII 1954, 9 ♂♂. Głęboczek, the lake, 22 VII 1953, 25 ♂♂, 18 ♀♀; 25 VII 1954, 21 ♂♂, 13 ♀♀; 11 VIII 1954, 8 ♂♂, 9 ♀♀. The brook, 22 VII 1953, 4 ♂♂, 3 ♀♀. Zielonka, the lake, 19 VII 1953, 6 ♂♂, 2 ♀♀; 25 VII 1954, 8 ♂♂, 5 ♀♀; 11 VIII 1954, 1 ♂, 3 ♀♀; 24 VIII 1954, 9 ♂♂, 4 ♀♀. Kamińskie Lake, 18 VIII 1954, 3 ♂♂, 4 ♀♀. Huciska, Miejskie Lake, 25 VIII 1954, 1 ♂, 1 ♀. Distr. Wągrowiec: Durowskie Lake, 14 VI 1953, 5 ♂♂. Skockie Lake, 11 VI 1954, 7 ♂♂, 2 ♀♀ (1 ♀ macropterous) (J). N Włókna Lake, 27 V 1953, 1 ♀ (J). Distr. Gniezno: Turostowo, the lake, 24 VIII 1954, 3 ♂♂, 3 ♀♀. Lednica Lake, 14 VIII 1953, 1 ♂, leg. J. Serafińska. Distr. Konin: Ślesińskie Lake, 25 VIII 1953, 1 ♂, 2 ♀♀, leg. J. Mirek. Distr. Nowy Tomyśl: Niepruszewskie Lake, 28 VII 1954, 79 ♂♂, 33 ♀♀, leg. K. Skarżyńska. Distr. Poznań: Morasko, Glinnowieckie Lake, 9 VIII 1953, 8 ♂♂, 7 ♀♀; 23 V 1954, 7 ♂♂. Stęszewice, Tuczno Lake, 18 VI 1953, 3 ♂♂, 1 ♀. Kołatkowskie Lake, 28 VI 1936, 1 ♂, 2 ♀♀; 18 VI 1953, 31 ♂♂, 13 ♀♀; 26 VII 1953, 45 ♂♂, 16 ♀♀; 15 VIII 1954, 1 ♀. Stęszewskie Lake, 18 VI 1953, 13 ♂♂, 11 ♀♀. Wronczyńskie Lake, 18 VI 1953, 1 ♂, 5 ♀♀. Uzarzewskie Lake, 16 VI 1954, 13 ♂♂, 18 ♀♀ (T). Góra Lake, 12 VI 1955, 8 ♂♂, 6 ♀♀, leg. Z. Pniewski. Promno, Dębiniec Lake, 4 VIII 1953, 34 ♂♂, 13 ♀♀ (T). Jezierce, Ully Lake, 24 VI 1955, 25 ♂♂, 16 ♀♀, leg. J. Mirek. Baba Lake, 24 VI 1955, 85 ♂♂, 53 ♀♀, leg. J. Mirek. Bogucin, mill-pond, 17 VI 1954, 1 ♀. Lusowskie Lake, 6 VI 1936, 2 ♂♂, 2 ♀♀.

Poznań: Kierskie Lake, 10 VI 1935, 1 ♂; 27 VI 1936, 4 ♂♂, 40 ♀♀; 30 VII 1936, 2 ♂♂; 30 V 1937, 12 ♂♂; 5 VI 1954, 1 ♂, leg. K. Wolska; 10 VI 1954, 14 ♂♂, leg. K. Wolska. Kiekrz, peat-pond, 9 VI 1953, 13 ♂♂, 4 ♀♀ (J). Strzeszynek, the lake, 23 VII 1954, 7 ♂♂, 7 ♀♀. Golęcin, Bogdanka — brook, upstream from Rusałka Lake, 23 VII 1954, 3 ♂♂, 2 ♀♀. Rusałka Lake, 23 VII 1954, 841 ♂♂ (4 ♂♂ macropterous), 368 ♀♀ (31 macropterous). Edwardowo, the field pond („söll"), 25 V 1953, 1 ♀ macropterous, leg. J. Serafińska. Poznań - Rudnicze, the clay-pond, 26 V 1953, 17 ♂♂, 2 ♀♀. Poznań - Górczynek, N (small) clay-pond, 11 VI 1953, 21 ♂♂, 16 ♀♀; 17 VIII 1954, 1 ♂, leg. L. Berger. S (great) clay-pond, 11 VI 1953, 16 ♂♂, 21 ♀♀; 17 VIII 1954, 7 ♂♂, 6 ♀♀, leg. L. Berger. Poznań - Karolin. N clay-pond, 13 VIII 1953, 2 ♂♂. S clay-pond (Kajta), 7 VI 1953, 32 ♂♂, 28 ♀♀; 7 VI 1954, 14 ♂♂, 10 ♀♀; 24 VII 1954, 7 ♂♂, 2 ♀♀, leg. K. Skarżyńska. E clay-pond: 12 V 1953, 3 ♂♂; 29 V 1953, 16 ♂♂, 13 ♀♀; 23 VI 1953, 1 ♂, 3 ♀♀; 15 VII 1953, 47 ♂♂, 26 ♀♀; 13 VIII 1953, 10 ♂♂, 18 ♀♀; 8 IX 1953, 1 ♂; 20 V 1954, 12 ♂♂; 24 V 1954, 19 ♂♂, 3 ♀♀; 28 V 1954, 31 ♂♂, 13 ♀♀; 7 VI 1954, 3 ♂♂, 5 ♀♀; 17 VI 1954, 5 ♂♂, 2 ♀♀; 2 VII 1954, 2 ♂♂, 1 ♀; 14 VII 1954, 7 ♂♂, 5 ♀♀; 24 VII 1954, 36 ♂♂, 19 ♀♀; 9 VIII 1954, 18 ♂♂, 7 ♀♀; 21 VIII 1954, 2 ♂♂, 1 ♀; 2 IX 1954, 2 ♂♂, 4 ♀♀; 10 IX 1954, 2 ♀♀; 20 IX 1954, 1 ♂;

27 V 1955, 4 ♂♂; 6 VI 1955, 90 ♂♂, 59 ♀♀. Mill-pond: 28 V 1954, 1 ♂; 7 VI 1954, 1 ♂, 1 ♀; 17 VI 1954, 3 ♂♂; 2 VII 1954, 2 ♂♂; 9 VIII 1954, 3 ♂♂; 21 VIII 1954, 2 ♂♂; 2 IX 1954, 4 ♂♂, 1 ♀; Distr. Poznań: Swarzędzkie Lake, 20 VI 1937, 4 ♂♂, 3 ♀♀; 7 VI 1953, 4 ♂♂, 4 ♀♀; 3 VIII 1954, 54 ♂♂, 57 ♀♀, leg. L. Berger; 14 VIII 1954, 4 ♂♂, 9 ♀♀ (T); 29 V 1955, 3 ♂♂. Rosnowskie Lake, 4 VIII 1935, 6 ♂♂, 2 ♀♀. Rosnówko, Małe Lake, 27 VII 1949, 3 ♂♂. Jarosławieckie Lake, 27 VII 1949, 1 ♂. Dębno Lake, 21 VI 1936, 3 ♀♀; 29 VI 1953, 3 ♂♂, 1 ♀ (J). Stęszew, Lipno Lake, 29 VI 1953, 9 ♂♂, 3 ♀♀ (J). Puszczykowo, cut-off lake of Warta River, 31 VI 1955, 5 ♂♂, 2 ♀♀, leg. Z. Pniewski. Distr. Śrem: Osowa Góra, Kociołek Lake, 23 V 1936, 15 ♂♂, 8 ♀♀. Sowiniec, cut-off lake of the Warta River, 22 V 1953, 3 ♂♂, 2 ♀♀, all macropterous. Niwka cut-off lake of the Warta River, 5 VIII 1936, 11 ♂♂, 3 ♀♀, leg. L. Kruś. Gądki, clay-pond, 5 VI 1953, 10 ♂♂, 6 ♀♀ (J); 21 VII 1953, 1 ♀, leg. W. Serafiński; 19 VIII 1953, 11 ♂♂, 12 ♀♀ (S); 5 VI 1954, 14 ♂♂, 12 ♀♀ (J). Kórnik, Skrzynki Lake, 18 VIII 1954, 28 ♂♂, 13 ♀♀ (S). Kórnickie Lake, 18 VIII 1954, 2 ♂♂, 1 ♀ (S). Bnińskie Lake, 17 VIII 1953, 32 ♂♂, 46 ♀♀ (S); 18 VIII 1954, 13 ♂♂, 8 ♀♀ (S). Distr. Środa: Zaniemyśl, Wielkie Jeziory Lake, 26 VI 1953, 2 ♂♂, 5 ♀♀. Łękno Lake, 26 VI 1953, 1 ♂, 1 ♀. Raczyńskie Lake, 26 VI 1953, 3 ♂♂. Distr. Wolsztyn: Wolsztyńskie Lake, 29 VII 1953, 44 ♂♂, 32 ♀♀. Berzyńskie Lake, 29 VII 1953, 12 ♂♂, 8 ♀♀. Distr. Leszno: Przemęckie Lake, 30 VII 1953, 5 ♂♂, 6 ♀♀ (T). Lincjusz Lake, 30 VII 1953, 2 ♂♂, 2 ♀♀ (T). Distr. Rawicz: Grąbkowo, clay-pond, 23 VI 1955, 44 ♂♂, 14 ♀♀, leg. L. Berger. Distr. Kępno, Doruchów, clay-pond, 28 VI 1955, 50 ♂♂, 47 ♀♀, leg. L. Berger. Distr. Ostrzeszów: Ostrzeszów, clay-pond, 28 VI 1955, 4 ♂♂, 2 ♀♀, leg. L. Berger.

Province Warszawa. Distr. Siedlce: Muchawka Rivulet, 30 VII 1954, 4 ♂♂, 3 ♀♀. Chodów, Liwiec River, 30 VII 1954, 17 ♂♂, 8 ♀♀.

Province Wrocław. Distr. Lubań: Gryfów, the storage-lake, 21 VI 1954, 14 ♂♂, 18 ♀♀. Distr. Jelenia Góra, Pilchowickie Lake, 20 VI 1954, 14 ♂♂, 9 ♀♀. Distr. Trzebnica: Trzebnica, clay-pond, 13 VII 1955, 4 ♂♂, 1 ♀, leg. L. Berger. Wrocław: Oława River, 24 VI 1954, 5 ♂♂, 10 ♀♀.

Province Kielce. Distr. Końskie: Niekłań, Czarna River, 4 VIII 1954, 11 ♂♂, 8 ♀♀ (S). Distr. Jędrzejów: Żarnowiec, Biała Nida River, 6 VIII 1954, 3 ♂♂, 4 ♀♀ (S).

Province Lublin. Distr. Włodawa: Libiszów, Białe Lake, 27 V 1954, 7 ♂♂, 5 ♀♀, leg. W. Zwolski; 16 VII 1954, 1 ♀, leg. W. Zwolski.

Ecology

As results from the above list the material of *M. minutissima* (L.) dealt with in this paper consist of 3178 ♂♂ (7 macropterous) and 1619 ♀♀ (36 macropterous). They were collected in 185 samples at 127 habitats. Most of the habitats are lakes

ranging from small ones of less than 1 ha of area to such lakes as Gopło, Wielimie and Jeziorak (of over 20 km² of area). Among the lakes inhabited by this species there are quite shallow ones (depth 2—3 m) and such deep ones as Popielewskie Lake (depth 55 m). Apart from natural lakes *M. minutissima* (L.) occurs in artificial ones, such as storage-lakes too. It may also be found in ponds when their depth exceeds 2 m, e. g. in mill-ponds, clay-ponds and in cut-off lakes of the rivers. *M. minutissima* (L.) apparently avoids running waters; of 11 habitats of this kind, enumerated in my list, the majority (6) are rivulets in the close neighbourhood of lakes. There are only five cases, in which this species occurred in running waters far from any lakes, but in all of them the current was very slow, often hardly marked.

At 46 habitats *M. minutissima* (L.) occurred as the only species of the genus. More often it was accompanied by others, especially by *M. griseola* Horv., with which it shared 61 habitats, dominating at 18 and being almost equally abundant at 6. At the remaining 37 habitats it was less numerous than *M. griseola* Horv., often forming a very small part of the population. At 14 habitats, mostly in clay-ponds, *M. minutissima* (L.) was found together with *M. meridionalis* (Costa). In 6 of them *M. griseola* Horv. joined as the third species of the genus, in one — the E clay-pond at Karolin, *M. poweri* (Dgl. Sc.) was added as a fourth in a four-species association. In clay-ponds *M. minutissima* (L.) formed a rather important part of the associations, in three cases it was even dominant. The Wielimie Lake was the only habitat where I personally found *M. poweri* (Dgl. Sc.) as the only companion of *M. minutissima* (L.), the second was the Czarna River (near Kielce) where the sample was taken by E. Smoleńska. The association of three species, namely *M. minutissima* (L.) accompanied by *M. griseola* Horv. and *M. poweri* (Dgl. Sc.) is more frequent, I have found it in three lakes and one mill-pond.

While all the other Polish species of *Micronecta* Kirk. are usually found in large numbers, *M. minutissima* (L.) seems to be inclined to a rather scattered occurrence. Most often it makes a less significant addition to other species. On the other hand, when at a habitat only single specimens of

Micronecta KIRK. were dispersed here and there, they belonged almost certainly to *M. minutissima* (L.).

Nevertheless I sometimes observed considerable, usually local concentrations. Such an exceptionally abundant one I have found on July 23, 1954, in Rusałka — an artificial lake at Poznań. A 2 m drag with a hand-net on the lake bottom, which was covered with *Lemna trisulca* L., grasses and filamentous green algae, supplied me with a catch of nearly 1000 specimens. The cause of such an enormous accumulation were undoubtedly the strong waves at the opposite bank of the lake and the insects seemed to seek refuge here.

As stated above, *M. minutissima* (L.) lives mainly in lakes and more often in smaller and shallower ones, with a rather muddy and overgrown bottom, and with recesses giving shelter against the waves. Thermal needs seem in this species higher than in others of the „*minutissima*"-group. The oxygen demand is probably more moderate. In these respects *M. minutissima* (L.) resembles *M. meridionalis* (COSTA) and is, therefore, its most constant companion. The occurrence of this species in the lakes fed by the Cybina Rivulet and its tributaries is characteristic. *M. minutissima* (L.) is at these habitats the only member of the genus, and occurs there rather abundantly. All these lakes, having generally favourable conditions, seem to have nothing peculiar that might be responsible for the absence of the other species.

M. minutissima (L.) shows a considerable expansion, taking possession of many new artificial waters such as storage-lakes, and clay-ponds. Clay-ponds, often fed only be spring-waters, have no connection with other water bodies, so that in colonising them only the macropterous specimens can be taken into account. Although they are rare in this species (this is the first record of their occurrence), they appear sometimes in relatively large numbers, as e. g. in the Rusałka Lake at Poznań. The macropterous ♀ taken in the isolated cattle-pond at Edwardowo must have been migratory, as it was the only specimen of *Micronecta* KIRK. ever found there (the pond was visited many times). Also the 3 ♂♂ and 2 ♀♀ from the stagnant water near the Warta River at Sowiniec should be regarded as migratory. At this habitat the mentioned

specimens were the only members of *M. minutissima* (L.), and as I have pointed out (see p. 264) only such macropterous specimens can be considered autochthonous which are accompanied by much more numerous brachypterous ones.

A phenomenon peculiar to *M. minutissima* (L.) are the ♂♂ prevailing greatly in numbers over the ♀♀. In the total number of specimens in my material of this species the sex ratio may be expressed as 100:51. Disregarding the least numerous samples (43), from the remaining ones (138) the ♂♂ predominate in 88 and the ♀♀ in 24 only. The numbers of both sexes are similar in 26 samples. As to some spring samples and a few summer ones, the predominance of the ♂♂ or even their exclusive presence is a consequence of the earlier development of the ♂♂, common to all our species of the genus. The catches were made at a time when the ♀♀ had not yet undergone the final metamorphosis or had just begun it. Such samples, however, are compensated by others got during the periods of the generation's decline when the ♀♀ gain dominance, the ♂♂ perishing earlier. At first I supposed that this strange disproportion resulted from different needs or habits of the two sexes. The ♀♀, perhaps living in greater depth, more often miss the net. However, a haul from the bottom of the Bnińskie Lake at a depth of 1,5 m brought a sample with ♂♂ prevailing to the same degree as in a sample from the water-edge. Remarkably enough, Leth (1943) mentioning in his paper the numbers of specimens of *M. minutissima* (L.) in Danish collections, namely 1367 ♂♂ and 581 ♀♀ (the disproportion is here even still larger than in my case), confirms my statement. This seems to prove as well that in Denmark *M. minutissima* (L.) is occurring predominately, as *M. griseola* Horv., which Leth did not distinguish, has both sexes equally numerous.

Development

The development of *M. minutissima* (L.) has not been described yet, and my observations are rather scanty too. Probably in many regards it resembles that of *M. griseola* Horv. Like our other species of *Micronecta* Kirk. the larvae hibernate mainly in the fourth and partly in the third stage. In a sample got from under the ice in the E clay-pond at

Karolin on March 28, 1954, I have found three larvae of the third and ten of the fourth stage. They differed from those of *M. griseola* Horv. and of *M. poweri* (Dgl. Sc.) by having larger eyes, narrower synthlipsis and being somewhat larger in size. There are also differences in the tint of their dark pattern, which is in *M. minutissima* (L.) rather grey, while in *M. griseola* Horv. it is brown, and dark brown in *M. poweri* (Dgl. Sc.). The first nymphs (fifth stage) appeared in the E clay-pond on May 10, when the temperature of the water reached 16° C. The dimensions of the early spring larvae from this pond were:

Stage	Length in mm	Breadth in mm
III	1,14—1,2	0,63—0,7
IV	1,49—1,57	0,89—0,92
V	1,86—1,94	1,03—1,12

In the same pond on May 20, 1954, I collected the first mature specimens. They were all ♂♂, and only four days later I found the first freshly metamorphosed ♀♀. In 1953, the spring being earlier, I came across some fully developed ♂♂ in this pond even on May 13, but in 1955 the late frosts delayed the development of *M. minutissima* (L.) till May 27. The time of the last ecdysis was almost always the same as in *M. griseola* Horv., 5—7 days later than in *M. poweri* (Dgl. Sc.) and preceeding *M. meridionalis* (Costa) by over a week (8—12 days). *M. minutissima* (L.) is enduring the conditions of laboratory breeding better than other species. This was the only species from which I succeeded to obtain single adult specimens developed from larvae bred in a Petri dish. These larvae were taken from the E clay-pond at Karolin in spring 1954; in one case a ♂ was the result of 22 days breeding of over 60 larvae of the fourth stage taken on April 14, in another also a ♂ developed from a nymph (fifth stage) after two days.

As said previously, there are in our country two generations during the year, both differing in size: the spring one, developed from the overwintering larvae, and the summer generation hatched from eggs laid in May and June by the spring ♀♀. After about four weeks since the appearance of the first adults the spring generation begins to decrease, the ♂♂ disappearing first, the disproportion of the sexes diminishes and finally the ♀♀ gain even predominance. About the middle of July the first members of the summer generation

mature. As in spring, the ♂♂ are the first to mature, and from then onwards prevail again. Contrary to the rather simultaneous appearance of the spring generation the members of the summer generation appear during a longer time, as they develop gradually from eggs laid during the whole existence (over a month) of the spring ♀♀. In 1954 the last adult in the E clay-pond at Karolin was a ♂ found on September 20. In the preceeding catch on September 10 I collected only 2 ♀♀. If in our climatic conditions the third generation does occur, then it must be rare and its members few in number. I have never found either freshly metamorphosed specimens or nymphs (fifth stage) of this species later than August 10.

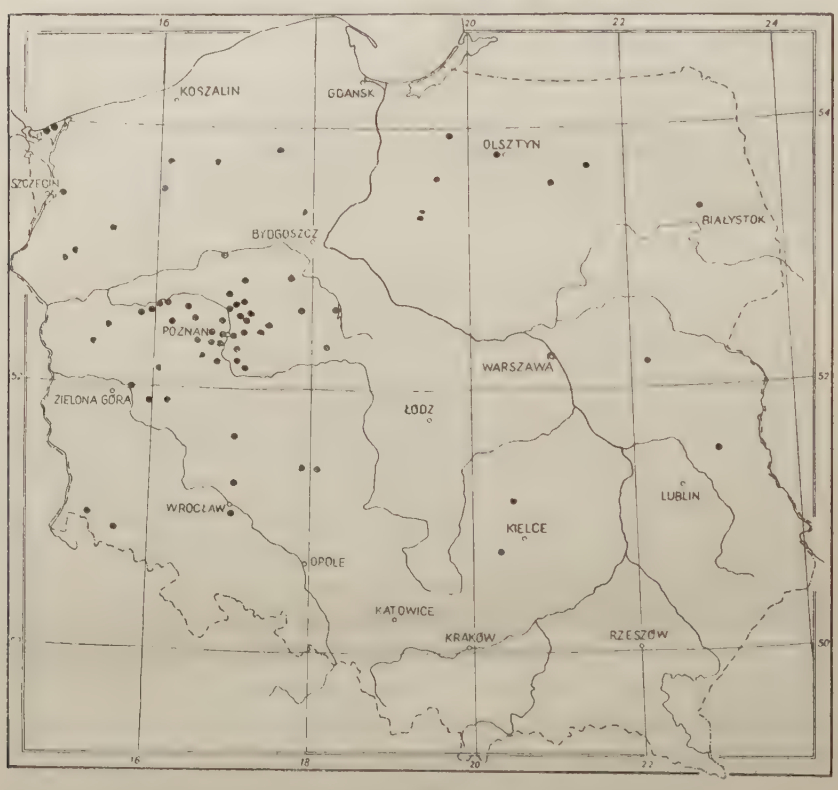
Geographical distribution

As a mainly lacustrine species *M. minutissima* (L.) is in our country more common in the Lake Regions of Pomorze, Mazury and Great Poland, though it may be found too beyond the limits of the postglacial lakes' occurrence. Beyond these limits the species inhabits suitable water bodies of artificial origin, such as storage-lakes, clay-ponds, and from among natural ones the stagnant waters near the rivers and even the rivers themselves, choosing here quiet recesses and such parts, where the current is slowest. I have never noticed *M. minutissima* (L.) in mountain streams and it is rather difficult to explain its presence in the storage-lakes of Pilchowice (near Jelenia Góra) and of Gryfów. Both these lakesare situated at the foot of the Sudety Mountains. As regards the Karpaty Mountains, the species avoids them. There are probably ecological factors causing that in Poland *M. minutissima* (L.) hardly ever passes 51° of latitude southwards. There is, however, no definite evidence that in other countries this species reaches farther south[1]. The records in the literature can not be regarded as reliable.

Undoubtedly this species occurs in England, Scotland and Ireland (Walton, 1938), in South- and Middle-Sweden (Lundblad, 1928) and finally in Finland (Linnavuori, 1951). The study of Horváth's material enables me to add two

[1] Quite recently, while this paper was in press, I have collected this species at Zbraslav (south of Praha, ČSR), on a station mentioned by Roubal (1957), then I have found it too in the material from the vicinity of Brno kept in the collections of the Národní Museum at Brno (ČSR).

stations in Finland: Sastmola and Nurmis, one in the USSR: Latvia („Livland", the exact locality unrecorded), finally one in Germany: Schartau (near Magdeburg).



Map 2. Polish stations of *M. minutissima* (L.).

This does not mean that *M. minutissima* (L.) is restricted to the above countries. The species is certainly occurring in the lake district of Vilnius and in Polesie in the USSR, since these provinces lie in the immediate neighbourhood of our habitats. In Germany it should, in my opinion, be as common as in Poland, especially in the lowlands. The presence of *M. minutissima* (L.) is also probable in Denmark (see p. 283), Holland, Belgium and in at least the northern parts of France. It would be very interesting to find out, how far southwards reach the habitats of this species in Germany and in other countries, and to define the eastern limit of its distribution.

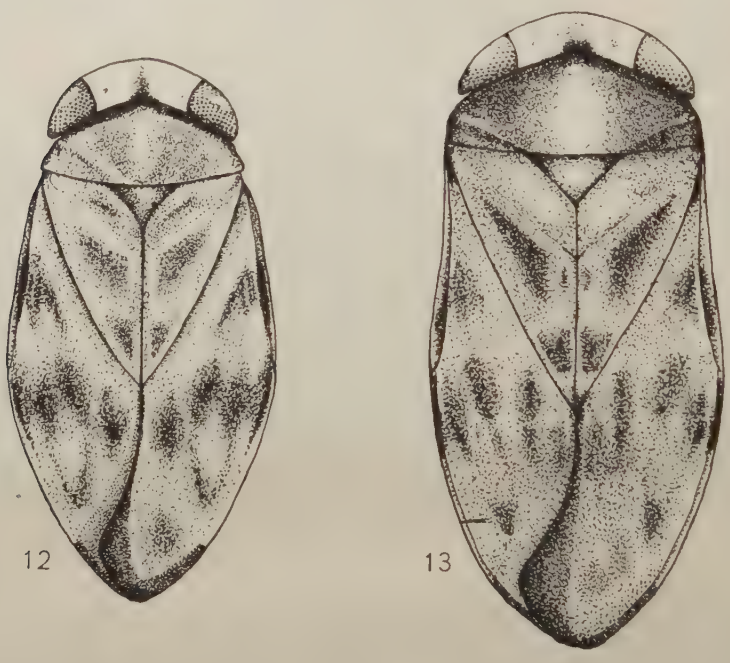
3. *Micronecta griseola* Horváth

? *Sigara minuta* Fieber, 1844.
? „ *minutissima* Fieber, 1861; Hagemann, 1917.
? „ *lemana* Fieber, 1861.
? „ *vitticeps* Horváth, 1895.
Micronecta perplexa Horváth, 1899 (ex parte); Jordan, 1943.
„ *minutissima* Horváth, 1899 (ex parte); Stobiecki, 1915 (ex parte); Jaczewski, 1934; Jordan, 1937; Wróblewski, 1939 a, 1952 (ex parte); Linnavuori, 1951 (non fig. 2 E); Wagner, 1952.
Micronecta nanula Horváth, 1916.
„ *distans* Poisson, 1938 (non fig. 30 A, B, D).

Brachypterous form, when seen from above, elliptical [Text-fig. 12], but the maximal breadth of the body, often lying further backwards, causes a rather pear-shape outline. The total length in my specimens is on the average 1,812 (1,516—2,116) mm in the ♂♂ and 1,838 (1,544—2,174) mm in the ♀♀. Sexual dimorphism small; much more considerable is the seasonal one. The average length of specimens collected in May and June (spring generation) is 1,891 mm in the ♂♂ and 1,921 mm in the ♀♀, while of those taken in the summer months it is in the ♂♂ 1,755 mm and in the ♀♀ 1,788 mm. The following table shows the participation of both generations in the different classes of length:

	♂♂		♀♀	
Generation	Spring	Summer	Spring	Summer
Months	V—VI	VII—IX	V—VI	VII—IX
1,5 —1,55 mm	—	4	—	2
1,55—1,6 „	—	10	—	11
1,6 —1,65 „	1	16	—	18
1,65—1,7 „	2	63	3	50
1,7 —1,75 „	8	119	10	86
1,75—1,8 „	25	59	17	59
1,8 —1,85 „	29	41	22	52
1,85—1,9 „	84	35	38	74
1,9 —1,95 „	73	14	64	31
1,95—2 „	29	5	45	10
2 —2,05 „	11	3	24	7
2,05—2,1 „	3	—	15	2
2,1 —2,15 „	2	—	3	—
2,15—2,2 „	—	—	1	—

The maxima of frequencies fall approximately in the classes corresponding to the seasonal averages. Only the ♀♀ of the summer generation show a second maximum in the 1,85—1,9 class caused certainly by larger specimens of the spring generation surviving the ♂♂, and still occurring in July together with the new ♀♀ of the summer generation. The breadth, de-



tig. 12 and 13. *Micronecta griseola* Horv. 12. Brachypterous ♂ from Fe E clay-pond at Poznań-Karolin, 24 V 1954. 13. Macropterous ♀ from the Czechowskie Lake (near Białystok), 28 VII 1954.

pending on the length, fluctuates between 0,77 and 1,09 mm. The body is on the average 1,995 (1,818—2,259) times as long as it is wide in the ♂♂ and 2,003 (1,823—2,25) times in the ♀♀. The variation of this proportion is rather great, but the 1,95—2 class is formed by 43 per cent of the total number of specimens.

Head almost as long in the middle as at the sides near the eyes. The synthlipsis to the eye-breadth ratio equals in the ♂♂

1,696 (1,44—2) and in the ♀♀ 1,717 (1,467—2). The averages agree with WAGNER's (1952) records and are somewhat less than those stated by LINNAVUORI (1951). There is in this ratio some seasonal dimorphism perceptible, the spring generation having a relatively narrower synthlipsis. Besides the dark stripe along the vertex, widened in dark specimens to form a rhombic figure, there are two little lateral paler spots. The eyes in the specimens preserved in alcohol are red with a bricky tint. The antennae do not show any features remarkable for the species. The lengths of their joints in mm are as follows:

	♂♂	♀♀[1]
I	0,074 (0,059—0,087)	0,073 (0,065—0,085)
II	0,041 (0,032—0,047)	0,045 (0,038—0,053)
III	0,137 (0,118—0,16)	0,143 (0,122—0,156)

Pronotum always broader than the head, above more convex, the tubercle in the middle of the anterior margin less distinct and shorter than in *M. minutissima* (L.). Pronotum-length, depending on size of specimens, in both sexes 0,244 (0,214—0,27) mm, the breadth on the average 2,81 (2,56—3,14) times larger than the length in the ♂♂ and 2,88 (2,67—3,05) times in the ♀♀. This ratio attains or surpasses the value 3 in barely 10 per cent of specimens.

Hemielytra narrowing moderately towards the membranes, their pubescence seems to be as in *M. minutissima* (L.). Hemielytra as a rule more opaque and of a dull surface. The dark pattern differs from that of *M. minutissima* (L.), the spots in the middle of the corium being broader and shorter; if they meet one another, they guard their individuality, not melting together into a uniform transversal zigzag stripe which is so characteristic in *M. poweri* (DGL. SC.). The development of the dark markings depends of the colour of the waters' bottom; in specimens living on light bottom the markings suffer more or less a reduction, sometimes disappearing entirely.

The wings of the brachypterous form usually reach the posterior margin of the sixth abdominal tergite. Their length

[1] 180 ♂♂ and 14 ♀♀ measured.

averages 73,37 (63,82—82,4) per cent of the length of the hemielytra in the ♂♂. In the ♀♀ they seem to be somewhat shorter (on the average 72 per cent of the hemielytra).

Anterior legs of the ♂♂[1]:

Average length in mm		Length relatively to femur-length
Femur	0,274	100
Tibia	0,162	58,87 (53,43—67,76)
Pala	0,179	65,16 (60,29—71,52)
Claw	0,108	39,4 (31,61—45,8)

The femur-length averages 15,22 (13,7—16,4) per cent of the body-length in the ♂♂ and 13,7 (12,7—14,7) per cent in the ♀♀. In the ♀♀ the average length of the femur is 0,253 mm, of the tibiopala 0,257 mm.

Middle legs[1]:

Average length in mm			Length relatively to femur-length	
	♂♂	♀♀	♂♂	♀♀
Femur	0,641	0,653	100	100
Tibia	0,249	0,25	38,76 (36,2 —41,71)	38,3 (36,9 —40,5)
Tarsus	0,354	0,353	55,17 (51,34—60,9)	54,13 (52,74—55,16)
Claws	0,237	0,228	36,89 (30,36—41,97)	34,95 (33,33—39,52)

The femur-length averages 34,8 (33,3—38,4) per cent of the body-length in the ♂♂ and 35,2 (32,4—37,3) per cent in the ♀♀. The tarsus is in my specimens in the ♂♂ 1,483 (1,291—1,68) times as long as the claws, in the ♀♀ 1,534 (1,389—1,612) times. Linnavuori (1951) gives for this ratio the value 1,54—1,72 (after conversion) and Wagner (1952) even 1,7—1,9. As I have stated previously (see p. 275) this ratio can not serve as a criterion to separate this species from *M. minutissima* (L.). In all our species of *Micronecta* Kirk. the ♀♀ seem to have the mediane claws somewhat shorter than the ♂♂. In *M. griseola* Horv. the specimens living in lakes and the members of the spring generation have shorter claws too.

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[1] 180 ♂♂ and 14 ♀♀ measured.

Posterior legs[1]:

Average length in mm			Length relatively to femur-length	
	♂♂	♀♀	♂♂	♀♀
Femur	0,458	0,474	100	100
Tibia	0,356	0,363	77,89 (72,56—83,55)	76,55 (73,94—80,45)
Tarsus I	0,376	0,382	82,23 (76,91—89,18)	80,64 (77,11—83,71)
Tarsus II	0,164	0,166	35,91 (31,39—40,18)	35,07 (32,94—39,22)
Claw	0,128	0,128	27,98 (23,89—32,14)	27,01 (24,45—28,88)

The femur-length averages in the ♂♂ 25,2 (23,6—26,7) per cent of the body-length and in the ♀♀ 25,6 (24,4—26,5) per cent. The great similarity of this ratio in *M. griseola* Horv. and *M. minutissima* (L.) is striking.

In the ♂♂ the abdomen is dark in colour save for the last segments (VI—VIII); this makes it easy to discover them at once in samples where this species is mixed with *M. minutissima* (L.). The outline of the lateral tongue of the fifth tergite or prestrigilar flap [Pl. XXV, fig. 39—41] crescent-like; it is well drawn by Wagner (1952). Its tip, often ragged, is seldom (Poprad River in Rytro) more stretched [Pl. XXV, fig. 41], approaching in some degree its shape in *M. poweri* (Dgl. Sc.). The free lobe of the eighth segment of the ♂♂ [Pl. XXV, fig. 42—46] varies greatly; its posterior margin is usually more convex than in *M. minutissima* (L.), though I have never met such an outline as shown in Wagner's (1952) figure. Right paramere [Pl. XXV, fig. 27—30] distinguished by a stability of form not met with in other species. Its free portion, narrower than in *M. minutissima* (L.), has on the concave margin a bend at very obtuse angle, sometimes scarcely apparent. The concavity in the distal part very shallow, the tip, which is shorter, also of different shape than in *M. minutissima* (L.). The left paramere [Pl. XXV, fig. 31—38] differs from that of *M. minutissima* (L.) chiefly by the shape of the apex, there being as a rule a saddle-like incision formed between the tip and a slanting ridge protruding beak-like laterally. Contrary to the right paramere the left one is more varying in shape as shown on the figures. Nevertheless the

[1] 180 ♂♂ and 14 ♀♀ measured.

typical form [Pl. XXV, fig. 31] is most frequent and occurs in 90 per cent of the specimens.

The macropterous form [Textfig. 13], much more common in this species than in all other Polish species, is almost as frequent in the ♂♂ as in the ♀♀. It is distinguished by the same characters as such a form in every other species of the genus: by a larger size, the more elongated and parallelsided body, the big pronotum and the apparently short head. The average length of the 52 ♂♂ which I could study is 2,094 (1,802—2,288) mm, of the 68 ♀♀ 2,136 (1,916—2,288) mm. The seasonal variation in size is not less marked than in the brachypterous specimens. Average length of specimens collected in May and June is: ♂♂ 2,148 mm, ♀♀ 2,164 mm, while of those caught in July and August it is: ♂♂ 2,028 mm, ♀♀ 2,095 mm. The body-length to breadth ratio is in the ♂♂ 2,152 (2,028—2,333), in the ♀♀ 2,171 (2,053—2,414). The most elongated specimens are fairly similar in shape to the *Corixinae*. The synthlipsis to eye-breadth ratio is on the average 1,686 (1,517—1,852) in the ♂♂ and 1,683 (1,538—1,857) in the ♀♀, thus almost the same as in the brachypterous form. The pronotum is much broader than the head (by 14 per cent of the head-breadth on the average); it is also longer and distictly convex. In the ♂♂ the pronotum is 2,443 (2,222—2,778) times as wide as long, in the ♀♀ 2,404 (2,154—2,727) times. Hemielytra parallelsided, membranes well developed. The brown tergites shining through the hemielytra obscure to a certain degree the dark pattern, which is less visible on the darkened background. The macropterous specimens seem therefore more scantily pigmented than the brachypterous ones accompanying them.

Synonymical notes

M. griseola Horv. for a long time shared the fate of other Horváth's species having been found only by that author. It would be still recorded as a Balcanic species, had not Poisson (1938) given its more detailed description, and above all the figures of the ♂♂ parameres. Now having Lundblad's (1928) description of *M. minutissima* (L.) and both species confronted by Linnavuori (1951) and Wagner (1952) it was

easier to notice that under „*M. minutissima* (L.)" several authors, and I myself too, confused really two species: the true *M. minutissima* (L.) and *M. griseola* Horv.

Horváth himself, having established *M. griseola* Horv. on the ground of insufficiently valid criteria, confused this species with others. In his material from the Museum of Budapest there are 111 specimens determined by him as *M. minutissima* (L.). Only 8 are correctly identified as really belonging to that species; of the remainder about 30 are *M. poweri* (Dgl. Sc.) and the rest are *M. griseola* Horv.

Nevertheless, *M. griseola* Horv. must be accepted as a valid species, since its types in Horváth's material from the Budapest Museum, examined by me, as well as the paratypes in Paris represent a good species, different from *M. minutissima* (L.) Lundblad (1928). Horváth's (1899) description of *M. griseola* Horv. is the first one which is definitely referring to this species; all others prior to it are uncertain. Thus *M. lemana* (Fieb.) may rather concern *M. poweri* (Dgl. Sc.), but the clearing up of this question is impossible as the type is missing. *M. vitticeps* Horv., as well as *M. perplexa* Horv. resemble more *M. poweri* (Dgl. Sc.) in appearance of their types. The resolving of the doubts is at present difficult the types being exclusively ♀♀.

My synonymic list of *M. griseola* Horv. begins with *Sigara minuta* Fieber (1844) and *S. minutissima* Fieber (1861). In Horváth's material there were two ♂♂ on a pin labelled „Coll. Fieber"; one of them which I mounted in a microscopical preparation proved to be *M. griseola* Horv. Further evidence is of an ecological nature. The just mentioned Fieber's species, as living in running waters, could not be *M. minutissima* (L.) which is mainly lacustrine, and rather avoids currents.

Judging chiefly according to its ecology *Sigara lemana* Fieber, as stated above, is more probably *M. poweri* (Dgl. Sc.). Here it is taken under consideration because of some possibility of its identity with *M. griseola* Horv. as well.

M. vitticeps Horv. will be discussed in the synonymical notes on *M. poweri* (Dgl. Sc.), though as an uncertain species, the identity of which with *M. griseola* Horv. is not quite excluded, I mention it in the list too.

Judging from the external appearance of the types, which are ♀♀, *M. perplexa* Horv. is most probably a macropterous form of *M. poweri* (Dgl. Sc.). Nevertheless among the specimens determined by Horváth as *M. perplexa* Horv. there are also 5 macropterous specimens of *M. griseola* Horv., namely 2 ♂♂ and 2 ♀♀ from Szt. Gotthard (Hungary) and a ♂ labelled „Valachie, Comana, A. L. Montandon" (Rumania). The identification of these specimens is quite sure as I have made preparations of two ♂♂ and examined their parameres. Another ♂, probably not belonging to the „types", was the subject of Jordan's preparation, and its parameres are figured in his paper (Jordan, 1943, fig. 5, 6 & 7) for comparison with those of *M. macrothoracica* Jordan. From the shape of the left paramere (the right one is drawn in a position which makes a comparison difficult) it is quite evident that *M. perplexa* Jordan (1943) is the macropterous form of *M. griseola* Horv.

As said above, under „*M. minutissima* (L.)" Horváth confused three species of which *M. griseola* Horv. was one. Though many of the specimens kept in his material at Budapest are of later collections (years 1928 and 1932), some of them taken before the publication of his synopsis (Horváth, 1899), determined by him as *M. minutissima* (L.), proved to be *M. griseola* Horv. when I dissected and examined them microscopically.

Stobiecki's (1915) *M. minutissima* (L.) is mainly *M. griseola* Horv. At least the ♀ from Rytro (Distr. Nowy Sącz) and 59 specimens from the Skawa River at Tomice (Distr. Wadowice) belong to *M. griseola* Horv., as I have found out after examining the material of this author.

As to *M. minutissima* Jaczewski (1934), the specimens from Mälarn (Sweden) belonged probably in fact to this species, on the other hand, those from Warsaw (Wisła River) and Tihany (Balaton Lake) were certainly *M. griseola* Horv. However, the right parameres of the ♂♂ from these three localities, shown on the figures (that are not exact enough), resemble one another too much.[1]

[1] It is unfortunately impossible to verify the matter, as the material has been lost during the second World War.

I have hinted above that Jordan's (1937) *M. minutissima* (L.) is probably *M. griseola* Horv. I shall return to this subject when discussing the development of this species (see p. 301—303).

As to my own old material already published (Wróblewski, 1939 a, b, 1952) I studied it again. *M. griseola* Horv. was then identified of course as *M. minutissima* (L.).

I have said quite enough about the identity of Linnavuori's (1951) and Wagner's (1952) *M. minutissima* (L.) with *M. griseola* Horv. Their mistake was probably a consequence of the belief that the more common species should be regarded as *M. minutissima* (L.).

I could prove beyond any doubt the identity of *M. nanula* Horv. with *M. griseola* Horv. As I said in the introduction, I was particularly interested in examining the type of *M. nanula* Horv. since the description of this species (Horváth, 1916) agreed relatively well with *M. carpatica* sp. n. In Horváth's materials from the Museum of Budapest were kept 2 ♂♂ types collected in 1909 at Kis Balaton by Horváth and 4 other specimens (3 ♂♂, 1 ♀) from Szantod (Hungary) collected in 1929 and also determined by him. All of them are smaller than average specimens of *M. griseola* Horv., the length of the types being 1,66 and 1,72 mm, of the other specimens 1,57—1,69 mm. All are very pale, in particular the specimens from Szantod, on the hemielytra of which the pattern is scarcely visible. All proportions and other characters agree with those of *M. griseola* Horv., above all the parameres of the ♂♂ (microscopical preparations were made of a ♂ type and a ♂ from Szantod) proved to be identical with those of this species. Horváth's (1916) description of *M. nanula* Horv. includes the rather strange statement, that this species is closely related to *M. meridionalis* (Costa), though actually among the European species of *Micronecta* Kirk. it is the most dissimilar one.

Although *M. distans* (Rey) is most likely the macropterous form of *M. poweri* (Dgl. Sc.), in *M. distans* (Rey) described by Poisson (1938) apparently two species are mixed. The left paramere on fig. 29 D and the right one on fig. 30 B belong to *M. griseola* Horv., those on fig. 30 A, C and D to *M. poweri* (Dgl. Sc.).

List of finds

Province Szczecin. Distr. Wolin: Lubin, the „Haff" of Szczecin, 26 VI 1948, 7 ♂♂, 8 ♀♀. Żółwińskie Lake, 29 VI 1948, 8 ♂♂, 8 ♀♀. Szczecin, Dąb Lake, 11 VIII 1953, 45 ♂♂, 29 ♀♀. Płona River, 11 VIII 1953, 4 ♂♂, 4 ♀♀. Distr. Gryfino: Miedwie Lake, 11 VIII 1953, 139 ♂♂, 84 ♀♀; 11 VI 1954, 46 ♂♂ (1 macropterous), 36 ♀♀. Distr. Choszczno: Klukom Lake, 11 VI 1954, 26 ♂♂, 17 ♀♀. Distr. Pyrzyce: Będzin Lake, 12 VI 1954, 32 ♂♂, 43 ♀♀. Distr. Myślibórz: Myśliborskie Lake, 12 VI 1954, 17 ♂♂, 19 ♀♀.

Province Koszalin. Kołobrzeg: Parsęta River, 4 VII 1948, 6 ♂♂, 4 ♀♀. Distr. Szczecinek: outflow from Trzesiecko Lake, 4 VI 1954, 2 ♂♂, 2 ♀♀. Trzesiecko Lake, 4 VI 1954, 48 ♂♂, 33 ♀♀. Drawsko Lake, 5 VI 1954, 11 ♂♂, 19 ♀♀. Distr. Drawsko: Wilczkowo Lake, 5 VI 1954, 49 ♂♂, 50 ♀♀.

Province Gdańsk. Distr. Kartuzy: Dąbrowa Lake, 1 VI 1954, 4 ♂♂. Distr. Kościerzyna: Kotel Lake, 2 VI 1954, 12 ♂♂.

Province Bydgoszcz. Distr. Chojnice: Męcikał, Kosobudy Lake, 3 VI 1954, 2 ♂♂, 1 ♀. Swornegacie, the lake in the forest, 3 VI 1954, 1 ♂. Charzykowo Lake, 3 VI 1954, 108 ♂♂, 34 ♀♀. Distr. Świecie: Drzycim, the lake, 22 VIII 1938, 3 ♂♂. Distr. Brodnica: Ciche Lake, 16 VIII 1953, 36 ♂♂, 19 ♀♀. Partęczyny Lake, 16 VIII 1953, 26 ♂♂, 32 ♀♀. Zbiczno Lake, 16 VIII 1953, 26 ♂♂, 31 ♀♀. Niskie Brodno Lake, 17 VIII 1953, 26 ♂♂, 29 ♀♀. Toruń: Wisła River, 26 V 1954, 13 ♂♂, 13 ♀♀ (1 ♀ macropterous). Martwa Wisełka River, 26 V 1954, 11 ♂♂, 27 ♀♀. Żnin: Małe Lake, 11 VIII 1953, 8 ♂♂, 11 ♀♀ (T)[1]. Distr. Inowrocław: Gopło Lake, 4 VIII 1953, 132 ♂♂, 156 ♀♀. Distr. Mogilno: Popielewskie Lake, 26 VI 1955, 69 ♂♂, 83 ♀♀.

Province Olsztyn. Distr. Susz: Jeziorak Lake, 15 VIII 1953, 29 ♂♂, 33 ♀♀. Distr. Ostróda: Drwęckie Lake, 23 VIII 1953, 3 ♂♂, 2 ♀♀. Olsztyn: Długie Lake, 11 VIII 1949, 1 ♂. Krzywe Lake, 25 VIII 1953, 3 ♂♂, 2 ♀♀. Olsztyn-Kortowo, Żabinek Lake, 21 VIII 1953, 37 ♂♂, 25 ♀♀; 22 VIII 1953, 21 ♂♂, 11 ♀♀. Distr. Mrągowo: Krutynia River upstream from Ukta, 17 VIII 1953, 4 ♂♂, 2 ♀♀ (J). Mikołajki Lake, 20 VI 1954, 1 ♂, leg. S. Kosicki. Distr. Węgorzewo: Przystań, Mamry Lake, 12 VIII 1949, 1 ♂; 16 VIII 1953, 16 ♂♂, 30 ♀♀ (J). Wilkus Lake, 28 V 1954, 5 ♂♂ (T). Distr. Giżycko: Tajty Lake, 30 V 1954, 7 ♂♂ (T). Szczytno: the lake in the forest, 18 VIII 1949, 3 ♀♀.

Province Białystok. Augustów: Necko Lake, 29 VIII 1953, 37 ♂♂, 49 ♀♀. Distr. Białystok: Czechowskie Lake, 28 VII 1954, 7 ♂♂, 8 ♀♀ (2 ♀♀ macropterous). The outflow of this lake, 28 VII 1954, 5 ♂♂, 3 ♀♀ (all macropterous). Białystok, Dolistówka Brook, 28 VII 1954, 12 ♂♂, 9 ♀♀.

Province Zielona Góra. Distr. Sulechów: Pomorsko, cut-off lake

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[1] (B) means leg. L. Berger, (J) — leg. J. Jaskowska, (S) — leg. E. Smoleńska, (T) — leg. A. Tschuschke.

of Odra River, 9 VII 1947, 5 ♂♂, 2 ♀♀. Distr. Głogów: Sławskie Lake, 29 VII 1953, 19 ♂♂, 28 ♀♀ (T).

Province Poznań. Distr. Piła: Krzyż, Drawa River, 7 VII 1955, 2 ♂♂, 1 ♀ (S). Motylewo, Gwda River, 5 VII 1953, 10 ♂♂, 5 ♀♀ (J). Distr. Czarnków: Drawski Młyn, Noteć River, 7 VII 1955, 2 ♂♂, 4 ♀♀ (S). Distr. Chodzież: Strzeleckie Lake, 6 VII 1953, 1 ♀ (J). Miejskie Lake, 6 VII 1953, 15 ♂♂, 25 ♀♀ (3 ♀♀ macropterous) (J). Distr. Międzychód: Radgoskie Lake, 13 VII 1954, 1 ♂, 3 ♀♀ (S). Tuczno Lake, 15 VII 1954, 2 ♀♀ (S). Gorzyńskie Lake, 15 VII 1954, 1 ♂, 1 ♀ (S). Mylin, Radziszewskie Lake, 7 VIII 1953, 13 ♂♂, 11 ♀♀. Wielkie Lake, 7 VIII 1953, 11 ♂♂, 23 ♀♀. Chrzypskie Lake, 7 VIII 1953, 7 ♂♂, 7 ♀♀. Śródka, Kuchenne Lake, 7 VIII 1953, 4 ♂♂, 5 ♀♀. Distr. Szamotuły: Samołęż Lake, 2 VII 1953, 5 ♂♂, 5 ♀♀, leg. W. Serafiński. Mormin Lake, 16 VI 1953, 6 ♂♂, 7 ♀♀. Bytyńskie Lake, 28 VIII 1953, 7 ♂♂, 6 ♀♀ (S). Distr. Oborniki: Rogoźno Lake, 1 VIII 1954, 1♂, 2 ♀♀, leg. Z. Pniewski. Jaracz, Wełna River, 11 VIII 1936, 17 ♂♂, 31 ♀♀. Wełna River upstream from Oborniki, 3 VI 1954, 8 ♂♂, 9 ♀♀ (J); 11 VII 1954, 25 ♂♂, 23 ♀♀; 8 VIII 1955, 3 ♂♂, 3 ♀♀. Sławica, the brook, 26 VIII 1954, 1 ♀. Głębocko, the brook, 25 VII 1954, 1 ♀. Głęboczek, the brook, 22 VII 1953, 1♀. Głęboczek, the lake, 25 VII 1954, 3 ♂♂ (1 macropterous); 11 VIII 1954, 1 ♀. Zielonka, the lake, 19 VII 1953, 31 ♂♂, 34 ♀♀; 25 VII 1954, 13 ♂♂, 9 ♀♀; 11 VIII 1954, 5 ♂♂ (1 macropterous), 5 ♀♀; 24 VIII 1954, 13 ♂♂, 12 ♀♀; 27 VI 1955, 2 ♂♂, 4 ♀♀ (all macropterous). Zielonka, the brook, 11 VIII 1954, 1 ♂, 1 ♀ (♀ macropterous); 23 VIII 1954, 1 ♂, 1 ♀; 27 VI 1955, 1 ♀ (macropterous). Murowana Goślina, the brook, 26 VIII 1954, 1 ♂, 1 ♀. Pławno Lake, 18 VI 1953, 2 ♂♂, 1 ♀. Kamińskie Lake, 18 VIII 1954, 21 ♂♂, 28 ♀♀. Distr. Wągrowiec: Rgielsko Lake, 14 VIII 1953, 4 ♂♂, 12 ♀♀ (T). Durowskie Lake, 14 VI 1953, 39 ♂♂, 46 ♀♀; 14 VIII 1953, 21 ♂♂, 38 ♀♀ (T). N Włókna Lake, 21 V 1936, 30 ♂♂, 36 ♀♀; 27 V 1953, 11 ♂♂, 11 ♀♀ (J). Distr. Nowy Tomyśl: Nieprószewskie Lake, 28 VII 1954, 15 ♂♂, 16 ♀♀, leg. K. Skarżyńska. Distr. Poznań Miękówko, Warta River, 15 VIII 1935, 7 ♂♂, 14 ♀♀. Kołatkowskie Lake, 25 VIII 1935, 1 ♂, 2 ♀♀; 28 VI 1936, 4 ♂♂, 22 ♀♀; 18 VI 1953, 43 ♂♂, 56 ♀♀; 26 VII 1953, 15 ♂♂, 15 ♀♀; 15 VIII 1954, 8 ♂♂, 12 ♀♀. Wronczyńskie Lake, 18 VI 1953, 5 ♂♂, 10 ♀♀ (2 ♀♀ macropterous). Lusowskie Lake, 6 VI 1936, 40 ♂♂, 47 ♀♀ (1 ♀ macropterous); 25 VII 1954, 6 ♂♂, 11 ♀♀, leg. Z. Pniewski.

Poznań: Kierskie Lake, 10 VI 1935, 47 ♂♂, 29 ♀♀; 29 VI 1935, 19 ♂♂, 37 ♀♀; 27 VI 1936, 7 ♂♂, 15 ♀♀; 30 VII 1936, 17 ♂♂, 30 ♀♀; 30 V 1937, 11 ♂♂, 22 ♀♀ (1 ♀ macropterous); 2 IX 1953, 11 ♂♂, 11 ♀♀, leg. M. Keffermüller; 27 IX 1953, 2 ♂♂, 5 ♀♀; 2 VI 1954, 36 ♂♂, 11 ♀♀, leg. K. Wolska; 22 VI 1954, 38 ♂♂, 25 ♀♀, leg. K. Wolska; 19 VIII 1955, 14 ♂♂, 9 ♀♀, leg. M. Keffermüller. Kiekrz, the peat-pond, 9 VI 1953, 1 ♀ (J). Poznań-Strzeszynek, the little lake, 23 VII 1954, 5 ♂♂, 3 ♀♀. Poznań-Zawady, the mouth of Cybina Rivulet, 11 IX 1935, 1 ♀. Poznań-Karolin, E clay-pond, 29 V 1953, 47 ♂♂, 32 ♀♀ (1 ♀ macropterous); 23 VI 1953, 12 ♂♂, 6 ♀♀; 15 VII 1953, 7 ♂♂, 7 ♀♀; 13 VIII 1953,

16 ♂♂, 22 ♀♀; 8 IX 1953, 1 ♂, 1 ♀; 20 V 1954, 13 ♂♂; 24 V 1954, 18 ♂♂, 10 ♀♀; 28 V 1954, 21 ♂♂, 18 ♀♀; 7 VI 1954, 11 ♂♂, 16 ♀♀; 17 VI 1954, 14 ♂♂, 10 ♀♀; 2 VII 1954, 16 ♂♂, 16 ♀♀; 14 VII 1954, 6 ♂♂, 6 ♀♀; 24 VII 1954, 3 ♂♂, 16 ♀♀; 9 VIII 1954, 19 ♂♂, 20 ♀♀; 21 VIII 1954, 2 ♂♂, 3 ♀♀; 2 IX 1954, 10 ♂♂, 4 ♀♀; 10 IX 1954, 2 ♀♀; 27 V 1955, 6 ♂♂; 6 VI 1955, 51 ♂♂, 28 ♀♀. Poznań-Karolin, Główna Rivulet, 28 V 1954, 4 ♂♂, 1 ♀; 7 VI 1954, 14 ♂♂, 7 ♀♀; 17 VI 1954, 23 ♂♂, 19 ♀♀; 14 VII 1954, 2 ♂♂, 2 ♀♀; 24 VII 1954, 1 ♂ (macropterous); 9 VIII 1954, 3 ♂♂, 2 ♀♀. Poznań-Karolin, the mill-pond, 28 V 1954, 10 ♂♂, 7 ♀♀; 7 VI 1954, 41 ♂♂, 18 ♀♀; 17 VI 1954, 8 ♂♂, 8 ♀♀; 2 VII 1954, 34 ♂♂, 30 ♀♀; 24 VII 1954, 2 ♂♂, 4 ♀♀, leg. K. Skarżyńska; 9 VIII 1954, 9 ♂♂, 9 ♀♀; 21 VIII 1954, 8 ♂♂, 2 ♀♀; 2 IX 1954, 3 ♂♂, 1 ♀. Poznań-Górczynek, N (small) clay-pond, 11 VI 1953, 1 ♂ (macropterous). Distr. Poznań: Bogucin, Główna Rivulet, 17 VI 1954, 11 ♂♂, 17 ♀♀. Bogucin, the mill-pond, 17 VI 1954, 4 ♂♂, 7 ♀♀. Swarzędzkie Lake, 1 VII 1953, 1 ♂, 1 ♀ (J); 14 VIII 1954, 1 ♀ (T). Biskupice, the lake, 20 VII 1955, 1 ♀ (macropterous), leg. J. Mirek. Wójtowstwo Lake, 4 VIII 1953, 36 ♂♂ (2 macropterous), 49 ♀♀ (T). Jezierce, Ully Lake, 24 VI 1955, 1 ♂ (macropterous), leg. J. Mirek. Baba Lake, 24 VI 1955, 4 ♂♂, 2 ♀♀ (all macropterous), leg. J. Mirek. Czapury, Głuszynka Rivulet, 20 V 1953, 9 ♂♂ (1 ♂ macropterous), 11 ♀♀. Luboń, Junikowski Brook, 1 IX 1935, 1 ♂, 2 ♀♀. Wiórek, Warta River, 1 IX 1935, 3 ♂♂, 7 ♀♀. Rosnowskie Lake, 4 VIII 1935, 1 ♂. Rosnówko, Małe Lake, 27 VII 1949, 1 ♀. Dębno Lake, 21 VI 1936, 40 ♂♂, 62 ♀♀; 29 VI 1953, 5 ♂♂, 26 ♀♀ (J). Dębienko, Bochenek Lake, 29 VI 1953, 3 ♀♀ (J). Distr. Gniezno: Turostowo, the lake, 24 VIII 1954, 2 ♂♂, 3 ♀♀. Lednica Lake, 2 VII 1953, 6 ♂♂, 16 ♀♀ (J); 14 VIII 1953, 16 ♂♂, 14 ♀♀, leg. J. Serafińska. Niedzięgiel Lake, 24 VIII 1953, 12 ♂♂, 5 ♀♀, leg. J. Mirek. Powidzkie Lake, 24 VIII 1953, 13 ♂♂, 18 ♀♀ (T). Wolsztyn: Berzyńskie Lake, 29 VII 1953, 15 ♂♂, 11 ♀♀. Distr. Śrem: Sowiniec, cut-off lake of Warta River, 22 V 1953, 55 ♂♂ (9 macropterous), 36 ♀♀ (9 macropterous). Sowiniec, the mouth of a brook, 30 VI 1953, 24 ♂♂, 41 ♀♀ (2 ♀♀ macropterous); 28 V 1954, 4 ♂♂, 3 ♀♀ (1 ♀ macropterous) (J). Sowiniec, Warta River, 30 VI 1953, 20 ♂♂, 34 ♀♀ (2 ♀♀ macropterous). Niwka, cut-off lake of Warta River, 5 VIII 1936, 11 ♂♂, 9 ♀♀, leg. L. Kruś; 5 VI 1953, 11 ♂♂ (5 macropterous), 7 ♀♀ (5 macropterous) (J). Rogalin, Warta River, 24 VI 1955, 4 ♂♂, 2 ♀♀, leg. Z. Pniewski. Krajkowo, Warta River, 8 VIII 1955, 19 ♂♂, 26 ♀♀, leg. E. Radziejewska. Gądki, clay-pond, 5 VI 1953, 2 ♂♂, 2 ♀♀ (J); 19 VIII 1953, 9 ♂♂, 5 ♀♀ (S); 5 VI 1954, 2 ♂♂, 1 ♀ (J). Kórnik, Skrzynki Lake, 18 VIII 1954, 19 ♂♂, 16 ♀♀ (S). Bnińskie Lake, 17 VIII 1953, 2 ♂♂, 3 ♀♀ (S); 18 VIII 1954, 6 ♂♂, 1 ♀ (S). Grzymisławskie Lake, 24 VIII 1954, 11 ♂♂, 12 ♀♀ (S). Ostrowieczno Lake, 25 VIII 1954, 1 ♂, 1 ♀ (S). Distr. Środa: Wielkie Jeziory Lake, 26 VI 1953, 64 ♂♂, 63 ♀♀. Małe Jeziory Lake, 26 VI 1953, 51 ♂♂, 61 ♀♀. Łękno Lake, 26 VI 1953, 16 ♂♂, 18 ♀♀. Solec, Warta River, 10 VII 1952, 30 ♂♂ (1 ♂ macropterous), 42 ♀♀ (1 ♀ macropterous). Distr. Września: Pyzdry, Warta River, 1 VII 1953, 32 ♂♂ (1 ♂ macro-

pterous), 44 ♀♀ (1 ♀ macropterous), leg. J. JASKOWSKI. Distr. Konin: Ślesińskie Lake, 25 VIII 1953, 55 ♂♂, 32 ♀♀, leg. J. MIREK. Konin, Warta River, 5 VIII 1955, 23 ♂♂, 19 ♀♀. Ratyń, Warta River, 5 VIII 1955, 5 ♂♂, 8 ♀♀, leg. M. KEFFERMÜLLER. Distr. Koło: Ochle, Warta River, 3 VIII 1955, 9 ♂♂, 13 ♀♀. Distr. Turek: Ostrosko, Warta River, 3 VIII 1955, 16 ♂♂, 16 ♀♀. Distr. Leszno: Dominickie Lake, 30 VII 1953, 90 ♂♂, 111 ♀♀ (T). Lincjusz Lake, 30 VII 1953, 17 ♂♂, 33 ♀♀ (1 ♀ macropterous) (T). Distr. Jarocin: Warta River, downstream from Nowe Miasto, 7 VIII 1955, 12 ♂♂, 15 ♀♀, leg. E. RADZIEJEWSKA. Orzechowo, Lutynia Rivulet, 7 IX 1954, 1 ♂, 1 ♀ (S); 6 VIII 1955, 2 ♂♂, 5 ♀♀. Distr. Krotoszyn: Zduny, the greater clay-pond, 20 VI 1955, 7 ♂♂, 7 ♀♀ (B). Zduny, the smaller clay-pond, 20 VI 1955, 64 ♂♂ (1 macropterous), 89 ♀♀ (2 macropterous) (B). Krotoszyn, clay-pond, 17 VI 1955, 1 ♀ (B). Distr. Kępno: Doruchów, clay-pond, 28 VI 1955, 1♂, 1 ♀ (B). Ostrzeszów, clay-pond, 28 VI 1955, 3 ♂♂ (2 macropterous), 6 ♀♀ (5 macropterous) (B).

Province Łódź. Distr. Łowicz: Łowicz, Bzura River, 27 VII 1954, 10 ♂♂, 7 ♀♀. Kalenica Brook, 27 VII 1954, 1 ♂, 1 ♀ (both macropterous), Bobrówka Brook, upstream from Okręt Pond, 27 VII 1954, 2 ♂♂, 6 ♀♀.

Province Warszawa. Warszawa: Wisła River, 30 VIII 1953, 13 ♂♂. 10 ♀♀. Distr. Siedlce: Chodów, Liwiec River, 30 VII 1954, 34 ♂♂, 30 ♀♀. Borki Siedleckie, Liwiec River, 30 VII 1954, 20 ♂♂, 12 ♀♀. Borki Siedleckie, the brook, left tributary of Liwiec River, 30 VII 1954, 2 ♂♂, 13 ♀♀. Siedlce, Muchawka Rivulet, 30 VII 1954, 6 ♂♂ (1 macropterous), 3 ♀♀.

Province Wrocław. Distr. Lubań: Gryfów, Kwisa River, 21 VI 1954, 1 ♀. Gryfów, storage-lake, 21 VI 1954, 7 ♂♂, 5 ♀♀.

Province Kielce. Distr. Końskie: Sołtyków, Kamienna River, 4 VIII 1954, 2 ♂♂, 1 ♀ (S). Distr. Kielce: Chęciny, Czarna Nida River, 5 VIII 1954, 5 ♀♀ (S). Distr. Jędrzejów: Żarnowiec, Biała Nida River, 6 VIII 1954, 14 ♂♂, 17 ♀♀ (S). Sobków, Nida River, 5 VIII 1954, 24 ♂♂, 28 ♀♀ (S).

Province Lublin. Lublin: Bystrzyca River, 31 VII 1954, 29 ♂♂ (1 macropterous), 51 ♀♀. Lublin-Dziesiąta, Czerniejówka Rivulet, 14 VI 1951, 3 ♂♂, 11 ♀♀ (2 ♀♀ macropterous), leg. W. ZWOLSKI; 31 VII 1954, 15 ♂♂, 8 ♀♀; 5 VI 1955, 19 ♂♂, 5 ♀♀, leg. W. ZWOLSKI. Distr. Parczew: Parczew, Piwonia Rivulet, 1 VIII 1954, 27 ♂♂, 16 ♀♀. Parczew, Konotopa Brook, 1 VIII 1954, 2 ♂♂, 1 ♀. Białkowskie Lake, 1 VIII 1954, 21 ♂♂, 29 ♀♀. Czarne Lake, 1 VIII 1954, 24 ♂♂, 28 ♀♀. Distr. Włodawa: Krasne Lake, 25 VIII 1955, 1 ♂, leg. W. ZWOLSKI.

Province Kraków. Oświęcim: Soła River, 7 VIII 1954, 9 ♂♂ (1 macropterous), 4 ♀♀. Distr. Olkusz: Ojców, Prądnik Stream, 20 VI 1955, 1 ♂ (macropterous), leg. Z. PNIEWSKI. Distr. Nowy Sącz: Rożnowskie Lake, 5 VIII 1954, 34 ♂♂, 22 ♀♀. Nowy Sącz, Dunajec River, 6 VIII 1954, 17 ♂♂, 22 ♀♀. Dąbrówka, cut-off loop of Dunajec River, 6 VIII 1954, 9 ♂♂, 5 ♀♀ (1 ♀ macropterous). Dąbrówka, Poprad River, 6 VIII 1954, 6 ♂♂, 12 ♀♀. Barcice, the streamlet, 6 VIII 1954, 1 ♀. Rytro,

Poprad River, 6 VIII 1954, 35 ♂♂ (7 macropterous), 58 ♀♀ (12 macropterous).

Province Rzeszów. Distr. Jasło: Jasło, Wisłoka Stream, 17 VI 1955, 1 ♂ (macropterous), leg. Z. Pniewski. Żmigród Nowy, Wisłoka Stream, 18 VI 1955, 1 ♂, leg. Z. Pniewski.

Ecology

The whole of my material of *M. griseola* Horv. consists of 3520 ♂♂ (52 macropterous) and 3601 ♀♀ (68 macropterous) taken in 238 samples from 168 habitats. Regarding the above list one can easily see that this is the most eurytopic among the Polish species of *Micronecta* Kirk. It readily inhabits both flowing and stagnant waters. Lakes make the majority (92) of the habitats, though rivers big and small are quite numerous too (43), then rivulets, streams and streamlets (18), clay-ponds (8), cut-off lakes and other stagnant waters along the rivers (4), mill-ponds (2) and a peat-pool.

M. griseola Horv. was found as the only species of the genus present at 62 habitats. They were mainly rivers, rivulets and streams, then lakes (23) and in two cases clay-ponds. At 64 habitats this species was accompanied by *M. minutissima* (L.), which was in most cases less numerous and equal in numbers or predominant in barely 28. Lakes (52) formed the greatest part of waters inhabited in common by both species. Together with *M. poweri* (Dgl. Sc.) *M. griseola* Horv. occurred at 28 habitats (11 lakes, 14 streams, streamlets and rivulets); *M. poweri* (Dgl. Sc.) was mostly prevailant. In four lakes and one mill-pond *M. griseola* Horv. was found in company with *M. poweri* (Dgl. Sc.) and *M. minutissima* (L.), in two other lakes and four clay-ponds it was accompanied by *M. meridionalis* (Costa) and *M. minutissima* (L.). *M. griseola* Horv. twice shared as a rather insignificant and only admixture the habitats of *M. meridionalis* (Costa). Finally the E clay-pond at Karolin is occupied by an association of four species, of which *M. griseola* Horv. is one.

In big and deep lakes *M. griseola* Horv. may be found almost always and in great numbers; it is usually the dominating if not the only species of the genus there. It prefers such places at the shores which are free of reeds and submerged

vegetation, and shallow places at the mouths of rivulets and brooks. While the water is calm the species feeds in crowds in the shallowest littoral coming to the very edge of the water, but when disturbed by waves it descends to the deeper parts dispersing widely.

In the rivers, especially the bigger ones, this is as a rule the only species of *Micronecta* Kirk. present. As to mountain streams I have observed quite abundant occurrence of this species in the Poprad (near Rytro), in others only in single specimens. In the upper courses of streams *M. griseola* Horv. retreats entirely and *M. poweri* (Dgl. Sc.) comes to occupy its place (the same substitution seems to take place in northern Polish lakes, e. g. in Pomorze). In running waters *M. griseola* Horv. assembles in little bays and recesses behind the groynes, at the mouths of tributaries, on the lee-side of sand-banks, at fords, i. e. in places least affected by the current.

The occurrence of *M. griseola* Horv. is depending of course on food supply, i. e. as in other species of the genus the fine plant-debris and the microflora covering the water bottom. But of much importance is a sufficient oxygen content too. The needs for oxygen are in this species higher than in others except in *M. poweri* (Dgl. Sc.) and *M. carpatica* sp. n. *M. griseola* Horv. is very sensitive to water pollution, industrial refuses exclude its occurrence, whilst town sewages either exclude or limit it too. On the other hand *M. griseola* Horv. finds a mild eutrophisation through cattle excrements convenient, therefore it appears in great abundance at watering places of lake-sides used by herds.

The absence of this species in the lakes of the Cybina Rivulet drainage area is interesting. Sometimes migratory macropterous specimens occur there, but they do not give origin to any stable and more numerous populations. There must exist in the water of the Cybina some unknown factor rendering impossible the development of *M. griseola* Horv.

Development

M. griseola Horv. is most probably the species which, as stated above (p. 252), Jordan (1937) studied when describing the development of „*M. minutissima* (L.)". My observations

on this subject, although made occasionally, and therefore neither regular nor complete enough, agree with JORDAN's quite well. In the dimensions of the larvae the differences may be seen only in the younger stages. They may be a result of difficulty in distinguishing of the young larvae belonging to *M. griseola* HORV. from those of other species of the „*minutissima*"-group.

Stage	Length in mm	Breadth in mm
I	0,686 (0,58)	0,343—0,372 (0,32)
II	0,858—0,887 (0,72)	0,458—0,515 (0,43)
III	0,972—1,087 (1)	0,572—0,658 (0,66)
IV	1,287—1,43 (1,3)	0,801—0,915 (0,9)
V	1,63 —1,86 (1,7)	0,944—1,144 (1)

In brackets are given the dimensions found by JORDAN (1937). While the winter samples of this author contained larvae mainly in the third and fourth stages, in my material of late autumn, of winter and of early spring there have been exclusively larvae of both these stages. Always too the larvae of the third stage made only a less numerous addition to those in the fourth stage. JORDAN's statement, that the larvae may winter in any other stage too, seems doubtful, and in my opinion the occurrence of nymphs (fifth stage) during the winter is quite impossible. More probable may be the presence of younger stages wintering, e. g. of the second, as on May 16, 1954, I have found one larva still in the third stage, while at the same habitat simultanously there were nymphs (fifth stage) and these also much advanced in development (fattened). The fourth stage in *M. griseola* HORV., as in our other species, seems to be a peculiar one, a stage of diapause. In all my breedings I observed that the earlier stages lasted 10 to 21 days, and when the larvae in late summer or in autumn reached the fourth stage the development stopped and they remained so during 2—3 months without any visible changes.

In laboratory breeding the larvae taken at the end of March, 1954, from the E clay-pond at Karolin became nymphs (fifth stage) by the middle of April, while in the mentioned clay-pond the first nymphs were found 3—4 weeks later. I came across the first adult specimens there on May 20, 1954,

they were of course ♂♂, the ♀♀ appearing 2—3 days later. In 1955 the long lasting frosts having delayed vegetation by 2—3 weeks, delayed the development of *M. griseola* Horv. by scarcely 7 days. As the temperature of the water is responsible to a great degree for the speed of the development, the appearance of adult specimens in lakes, especially in deeper ones, is always later. In 1954, in the Kierskie Lake (Poznań), which is 35 m deep, the first mature specimens of *M. griseola* Horv. were observed some 10 days after the first in the E clay-pond at Karolin.

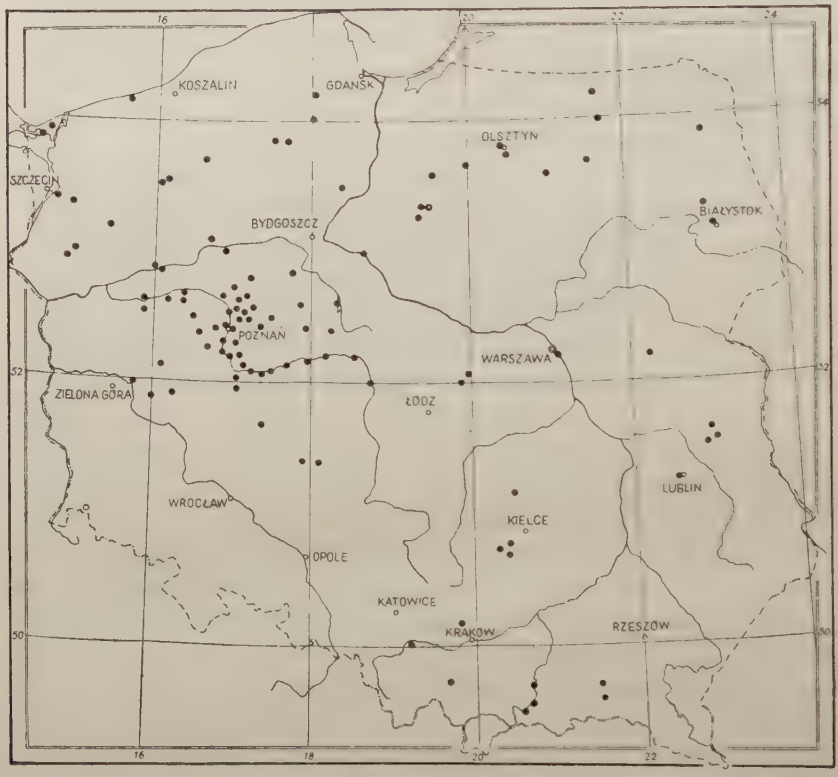
Jordan (1937) has correctly noticed the occurrence in Germany of a second generation in the same year. According to him it appears in August. I have observed it much earlier, having in the first half of July found freshly metamorphosed members of the summer generation. The time of appearance extends over 4—5 weeks, as they hatch from eggs laid during the whole life of the spring ♀♀, lasting over a month. Therefore in summer larvae of all possible stages as well as mature specimens may be found at the same habitat. In my opinion it is probable that the larvae hatched from the first eggs laid by the summer generation may finish their development in the same year as a third generation. In late August and in September specimens distinctly bigger, approaching in size the members of the spring generation are occasionally found. They may be only aberrant, but it seems not impossible that they are the rare specimens of the third generation and their „brothers" will hibernate as larvae.

The last imagines of *M. griseola* Horv. I collected in the E clay-pond on September 10, 1954; they were 2 ♀♀.

Geographical distribution

M. griseola Horv. is in our country the most common species of the genus. I have found it in almost every district investigated, excepting the northern parts of the Gdańsk Province and Silesia, apart from a single case in a storage-lake at Gryfów. The absence in the rivers and streams of Silesia is chiefly the consequence of them being polluted, often to a high degree, by industrial refuses. This absence

may be considered too, at any case partly, as a final result of thinning of the *M. griseola* Horv. frequence (due probably to ecological factors, and mentioned formerly) more and more apparent when approaching the mountains and on the other



Map 3. Polish stations of *Micronecta griseola* Horv.

hand the sea. This continuous reduction is accompanied at the same time by an also continual rise in the frequency of *M. poweri* (Dgl. Sc.); this last species seems to be replacing *M. griseola* Horv.

As to *M. griseola* Horv. outside of Poland its occurrence is quite sure in Rumania (Horváth, 1899), in Hungary (Horváth, 1916), in Southern France (Poisson, 1938), in Finland (Linnavuori, 1951), and in Germany (Wagner, 1952).

After having examined Horváth's material from the Museum of Budapest I am able to add Czechoslovakia (ČSR).

Many records mentioning *M. minutissima* (L.) really concern *M. griseola* Horv., but it is usually not easy to resolve this with certainty. There was no evidence till now of the presence of this species in the British Isles, Sweden and Norway. Its absence there seems probable. It has not been found in Italy either, though „*M. nanula* Horv." mentioned by Tamanini (1948) should be cleared up by an examination of more numerous material from Busalla.

M. griseola Horv. should in my view occur on the whole territory of Central Europe, and its distribution area certainly extends eastwards of Poland at least to the Middle Russian Upland, though there are at present no data to support these suppositions.

4. ***Micronecta poweri*** (Douglas and Scott)

? *Sigara lemana* Fieber, 1861.
„ *minutissima* var. *Poweri* Douglas and Scott, 1869.
„ *distans* Rey, 1890.
? „ *vitticeps* Horváth, 1895.
Micronecta minutissima Horváth, 1899 (ex parte), 1916 (ex parte); Stobiecki, 1915 (ex parte); Berg, 1938; Poisson, 1938; Smreczyński, 1954.
Micronecta perplexa Horváth, 1899 (ex parte).
„ *borealis* Lundblad, 1936.
„ *poweri* Walton, 1938.
„ *macrothoracica* Jordan, 1943.
„ *cornuta* Wagner, 1952.

Brachypterous form of elliptical outline [Textfig. 14]. The average total length of my specimens is 1,826 (1,544—2,031) mm in the ♂♂, and 1,944 (1,665—2,202) mm in the ♀♀. In this species the sexual dimorphism in size is much more distinct than in the others. Poisson (1938) already noticed that the ♀♀ are bigger. The size differences between the generations are, on the other hand, less apparent. The mean length of specimens collected during May and June is 1,834 mm in the ♂♂ and 1,991 mm in the ♀♀, while that of those taken in July and August is in the ♂♂ 1,804 mm and in the ♀♀ 1,902 mm. Some levelling of the differences in the seasonal length-averages

is caused by the fact that while the majority of my spring material of *M. poweri* (Dgl. Sc.) is collected in lakes, most summer samples were taken in running waters, and it seems to be a rule in this species that lacustral specimens are smaller than those living in streams, streamlets and rivulets. The

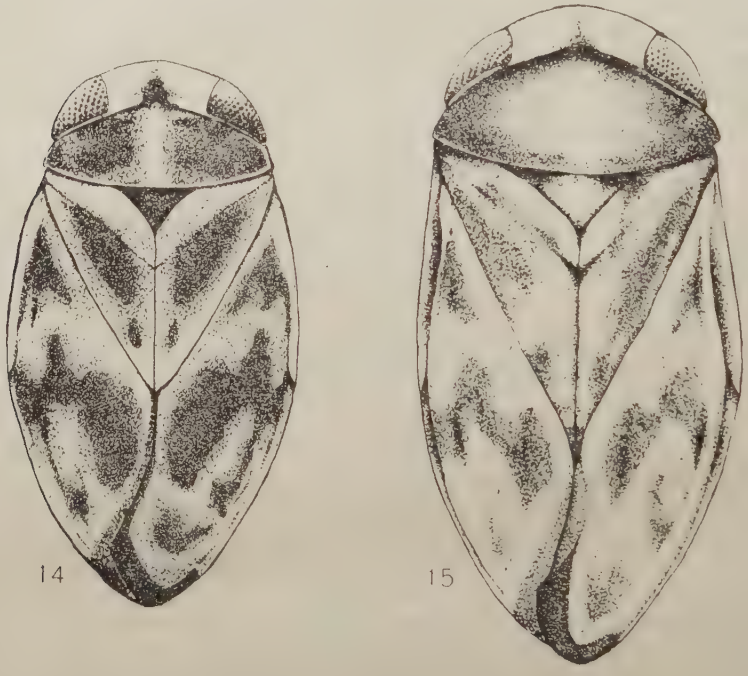


Fig. 14 and 15. *Micronecta poweri* (Dgl. Sc.). 14. Brachypterous ♂ from the E clay-pond (Poznań-Karolin), 24 IV 1954. 15. Macropterous ♂ from the Wisłoka Stream (Jasło), 17 VI 1955, leg. Z. Pniewski.

breadth, depending on length, fluctuates in the ♂♂ between 0,715 and 1,03 mm, and in the ♀♀ between 0,801 and 1,115 mm. The body is on the average 1,97 (1,781—2,154) times as long as wide in the ♂♂, and 1,955 (1,811—2,167) times in the ♀♀; it is thus a little less slender than in *M. griseola* Horv.

The head differs but slightly from that of *M. griseola* Horv., the vertex being somewhat more convex in front. It is thus longer in the middle than near the eyes. The synthlipsis is in the ♂♂ 1,776 (1,429—2,087) times as wide as the eye-breadth, and in the ♀♀ 1,806 (1,467—2,167) times. The value of this

ratio is greater than in any other of our species of *Micronecta* KIRK., the extent of its variation is greater too. Like in *M. griseola* HORV. the synthlipsis of the summer generation is relatively broader than in the spring one. The pigmentation of the vertex consists of a mediane stripe and of lateral spots. In dark specimens they form a large cross-like uniform blotch, spreading sometimes over almost the whole surface. The eyes in the specimens preserved in alcohol are red with a bricky tint as in *M. griseola* HORV. The head-breadth, always smaller than that of the pronotum, measures on the average 0,685 (0,578—0,758) mm in the ♂♂ and 0,72 (0,592—0,801) mm in the ♀♀. The antennae do not show any characters peculiar to the species. The average lengths of their joints in mm are[1]:

	♂♂	♀♀
I	0,073 (0,061—0,084)	0,078 (0,068—0,087)
II	0,037 (0,03—0,046)	0,041 (0,034—0,044)
III	0,133 (0,118—0,152)	0,145 (0,129—0,158)

The shape of the pronotum varies; its sides, which according to LUNDBLAD (1936) should be considerably longer than in *M. minutissima* (L.), are sometimes so, but that is far from the rule. The tubercle in the middle of the anterior margin is small, as in *M. griseola* HORV., but distinct by its light coloration, extending backwards as a pale stripe dividing the pronotum. Besides this the pronotum has a dark sandy-colour, brown or nearly black save for quite a large light stripe bordering the posterior margin. The length of the pronotum averages 0,239 (0,184—0,272) mm in the ♂♂ and 0,265 (0,231—0,303) mm in the ♀♀. The breadth to length ratio is in the ♂♂ 2,959 (2,64—3,2) in the ♀♀ 2,845 (2,549—3,183). The value of this ratio reaches the number 3 or surpasses it in about 50 per cent of the male specimens and in 20 per cent of the females.

Hemielytra narrowing apically, wedge-like and the membranes small therefore. In general the hemielytra of *M. poweri* (DGL. SC.), as well as the whole exoskeleton, show a stronger sclerotisation, being thicker and stiffer than in any other Polish species. They are as opaque as in *M. griseola* HORV.

[1] 54 ♂♂ and 10 ♀♀ measured.

but the surface is more glittering, the pubescence scanty. The colour of the background is sandy-yellow, grey or greenish-grey, the dark pattern contrasting well with it. The blotches forming the pattern are the same as in the other species, but their outlines are more sharply marked, in the middle of the corium they broaden, usually melting together to form a zigzag stripe running transversally from one margin to the other. This coloration feature makes it easy to distinguish *M. poweri* (Dgl. Sc.) from other species, even when only slightly magnified. The tint of the blotches is dark brown, almost black in inhabitants of the lowland rivulets and brooks, brown or reddish-brown in specimens from mountain streams and northern lakes. As in other species the dark pattern is quite often reduced, the blotches shortening and fading. The zigzag stripe usually keeps its coherence longer. In far advanced reduction it becomes broken and in extreme cases (in some lakes) the blotches disappear completely. Most conservative are the spots on the corium near the apex of the clavus, and those on the embolium. In a sample from the Wielimie Lake I found some specimens with the left hemielytra without any pattern and the right ones normally, however scantily patterned.

The wings in the brachypterous form of *M. poweri* (Dgl. Sc.) are much smaller than in *M. griseola* Horv. They usually reach the anterior margin of the sixth abdominal tergite and sometimes the middle of the fifth, their length measuring 63,12 (56,47—67,78) per cent of the length of the hemielytra in the ♂♂ and 65,18 (60,2—68,9) per cent in the ♀♀.

Anterior legs of the ♂♂[1]:

Average length in mm		Length relatively to femur-length
Femur	0,307	100
Tibia	0,196	64.08 (59.01—70.13)
Pala	0,205	66.69 (58.82—74.17)
Claw	0,129	42.14 (34.24—46.05)

The femur-length is 16,78 (15,7—18,1) per cent of the body-length in the ♂♂ and 14 (13,3—14,6) per cent in the ♀♀, the femurs being thus relatively longer than in the other

[1] 54 ♂♂ and 10 ♀♀ measured.

Polish species of the genus. Peculiar to the species is the great length of the tibia in the ♂♂, which may be seen in WAGNER's figure (1952, fig. 26) and in the dimensions recorded by LUNDBLAD (1936) too. The value of the pala-length given by WAGNER (1952) for *M. cornuta* WAGNER [which in my opinion is a synonym of *M. poweri* (DGL. SC.), see p. 314], namely 0,31 mm must be a mistake, being about twice to high. The average femur-length in the ♀♀ is 0,27 mm, the length of the tibio-pala 0,288 mm.

Middle legs[1]:

	Average length in mm		Length relatively to femur-length	
	♂♂	♀♀	♂♂	♀♀
Femur	0,663	0,692	100	100
Tibia	0,251	0,255	37,92 (35,08—39,64)	36,88 (34,65—38,47)
Tarsus	0,346	0,362	52,24 (48,63—56,02)	52,27 (50,55—53,63)
Claws	0,239	0,241	36,07 (28,8—42,77)	34,77 (31,18—37,77)

The femur-length amounts on the average to 36,2 (33,9—39,8) per cent of the body-length in the ♂♂ and to 35,8 (34,8—37,2) per cent in the ♀♀. The tarsus is 1,45 (1,22—1,72) times as long as the claws in the ♂♂ and 1,53 (13,5—1,71) times in the ♀♀. The claws are also relatively longer than in all our other species, *M. meridionalis* (COSTA) excepted. They are especially long in specimens collected in the Dolistówka Brook (Białystok); in this case the ratio of the tarsus to claws-length is 1,22—1,31.

For comparison I give below the proportions resulting from the data of other authors:

	LUNDBLAD, 1936	WALTON, 1938	WAGNER, 1952	My measurements ♂♂
Femur	100	100	—	100
Tibia	37,56	33,33	(37,92)	37,92
Tarsus	52,37	46,67	52,91	52,24
Claws	33,74	33,33	34,39	36,07

While LUNDBLAD's data agree well with mine, and WAGNER's[2] too, the ratios expressed in round numbers by WALTON differ considerably.

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[1] 54 ♂♂ and 10 ♀♀ measured.

[2] WAGNER's (1952) data concern *M. cornuta* WAGNER which is in my opinion identical with *M. poweri* (DGL. SC.).

Posterior legs[1]:

	Average length in mm		Length relatively to femur-length	
	♂♂	♀♀	♂♂	♀♀
Femur	0,465	0,495	100	100
Tibia	0,364	0,393	78,24 (74,32—83,34)	79,33 (76,5—82,68)
Tarsus I	0,378	0,41	81,41 (77,09—86,09)	82,7 (80,62—84,25)
Tarsus II	0,168	0,173	36,17 (32,41—39,84)	34,98 (32,86—37,01)
Claw	0,128	0,133	27,47 (22,4—30,44)	27,24 (23,1—30,55)

The femur-length averages 25,4 (23,8—26,9) per cent of the body-length in the ♂♂ and 25,6 (25,2—26,7) per cent in the ♀♀.

The abdomen resembles in coloration that of *M. griseola* Horv. The lateral tongue of the fifth tergite in the ♂♂ has a remarkable outline [Pl. XXVI, fig. 60—63], which allows the recognition of this species infallibly, although some variation is met with too. The differences may concern the length of the tip and the end of it, which being usually pointed, is blunt in some cases. Much less characteristic is the free lobe of the eighth segment [Pl. XXVI, fig. 64—66]. Its posterior margin is generally more convex than in *M. griseola* Horv., and when with an S-like sinuation then with the incision very shallow. The parameres of the ♂♂ of *M. poweri* (Dgl. Sc.) are so remarkable that any mistaking of them is out of the question. The right one [Pl. XXVI, fig. 47—52] is in its free portion rather stout. Beginning from the base it widens as if swelling, then proceeds gradually narrowing to the tip without any prominence on the concave margin. The tip is characteristic too. Variation is considerable as seen in the figures. Differences occur mainly in the breadth of the free part; sometimes the swelling at the base is less striking and the parameres then look similar to Poisson's (1938) „*M. minutissima* " (fig. 37 A—E). The left paramere is not less remarkable [Pl. XXVI, fig. 53—59]. Its free portion is erect, the tip usually slants on the exterior side, and the tubercle, although sometimes not protruding laterally, is always visible.

[1] 54 ♂♂ and 10 ♀♀ measured.

The macropterous form [Textfig. 15] is according to the general rule more elongated and more parallel-sided. But while in *M. griseola* Horv. the sides of the body are parallel for about $^2/_3$ of its length and then narrowing, in *M. poweri* (Dgl. Sc.) the narrowing begins already about the middle of the body. The total length of my only two ♂♂ is 2,031 mm and 2,174 mm, an average length of the 26 ♀♀ is 2,207 (2,059—2,317) mm. The body-length to breadth ratio is in the ♂♂ 2,028 and 2,235, in the ♀♀ it averages 2,183 (2,054—2,394). The synthlipsis is 1,77 and 1,85 times the eye-breadth in the ♂♂ while 1,772 (1,605—2) times in the ♀♀; the value of this ratio is thus greater than in *M. griseola* Horv., and as in the brachypterous form too. The pronotum is broader than the head by 18,3 per cent of the head-breadth. Its posterior margin is more convex than in the same form of *M. griseola* Horv. The pronotum is in the ♂♂ 2,439 and 2,458 times as wide as long, this ratio in the ♀♀ averages 2,439 (2,286—2,609). The hemielytra, though much more parallelsided than in the brachypterous form, are somewhat more narrowed than in the macropterous forms of *M. griseola* Horv. and *M. minutissima* (L.), the membranes are thus smaller. The dark pattern of my specimens is in all cases scarce, certainly in connection with the light bottom of their native habitats. The ♂♂ are very rare, and Walton (1938) mistakes the brachypterous form for them. This is obvious from his plate XI, fig. 1, and from the pronotum's proportion (p. 261) as well.

Synonymical notes

In the material received from the Museum of Budapest there is a ♀ with „*M. lemana* Fieb., det. Reuter, det. Horváth" and „Helvetia" on the labels. This specimen formed probably the basis for Horváth's (1899) statement that *M. lemana* (Fieb.) is identical with *M. minutissima* (L.). An external examination of this specimen does not permit me to state definitely its true specific position. Most likely it is a *M. poweri* (Dgl. Sc.), but it may be a *M. griseola* Horv. too. The pattern on the hemielytra is scarcely perceptible, the specimen being very pale. Horváth's opinion concerning *M. lemana* (Fieb.)

has since been commonly accepted, and the name regarded as a synonym of *M. minutissima* (L.). Quite often it was overlooked completely. Poisson (1938) was the first to question Horváth's (1899) statement. Without any discussion or explanation he simply places *M. lemana* (Fieb.) with an interrogation mark among the synonyms of *M. poweri* (Dgl. Sc.). Some details in Fieber's (1861) description seem to prove the correctness of Poisson's (1938) suggestion, especially the blackish zigzag stripe („Zackbinde") on the corium, and beside that the kind of habitats — brooks with clear water — ascribed to *M. lemana* (Fieb.) by Fieber (1861). As, however, this evidence is not sure enough, Poisson did not decide (and I am now of the same opinion) to substitute the earlier name *M. lemana* (Fieb.) for *M. poweri* (Dgl. Sc.). It is possible that Fieber confused under *M. lemana* (Fieb.), *M. poweri* (Dgl. Sc.) and *M. griseola* Horv., and that is why I have listed *M. lemana* (Fieb.) as a possible synonym of *M. griseola* Horv. too.

M. distans (Rey) is the macropterous form of *M. poweri* (Dgl. Sc.). Its macropterism is quite apparent from the description of the body and especially of the pronotum. The coloration infallibly indicates the species. The pattern of the hemielytra formed of brown spots, well contrasting and joining in the middle of the corium in a transversal stripe („réunis en leur milieu de manière à former derrière la pointe du clavus une bande transversale sinueuse") is unmistakable a feature of *M. poweri* (Dgl. Sc.).

According to Horváth (1899) *M. vitticeps* (Horv.) differs from „*M. minutissima* (L.)" and *M. griseola* Horv. by its pronotum being more transverse (3 times as wide as long, instead of 2,5 times in both other species), shorter than the head and without the median tubercle on the anterior margin. In Horváth's material from the Budapest Museum there are 2 ♀♀ labelled „typus". Their pronota are 2,8 and 2,9 times as wide as long, that is quite nearly so as in average specimens of *M. poweri* (Dgl. Sc.), *M. griseola* Horv. and *M. minutissima* (L.) too. The pronota of both specimens are longer than the heads by over $^1/_3$ of their length, and the tubercles on their anterior margins are quite distinct. The

remarkable light stripe along their posterior margin, the pattern of the hemielytra (not very distinct) and all proportions indicate that both ♀♀ belong to *M. poweri* (Dgl. Sc.). Nevertheless I put with the name an interrogation mark, as the identity is not absolutely sure.

The specimens from Edirne (Marica River, Turkey), identified by Hoberlandt (1948) as *M. vitticeps* (Horv.), undoubtedly belong to the „*meridionalis*"-group of species.

In Stobiecki's material of „*M. minutissima*" I found besides *M. griseola* Horv. a ♂ from Libertów (near Kraków) belonging to *M. poweri* (Dgl. Sc.). Leth (1943, p. 416) stated that Berg's (1938) „*M. minutissima*" was actually *M. poweri* (Dgl. Sc.).

I have already hinted (see p. 253) that Poisson (1938) has mistaken a part of his *M. poweri* (Dgl. Sc.) for *M. minutissima* (L.). The shapes of the parameres shown in the fig. 36 and 37 are a quite obvious proof of this. Especially the left parameres shown on the fig. 36 C, D and E when compared with those on the fig. 40 C, D and E (belonging to *M. poweri* Poisson, 1938) do not differ. Between the right parameres of Poisson's „*M. minutissima*" and *M. poweri* (Dgl. Sc.) there is some difference, though not of much importance. This difference results from the fact that Poisson's (1938) specimens of „*M. minutissima*" are representing the lacustrine form (from Lac Chambon), while the others (*M. poweri* Poisson, 1938) belong to the typical form from flowing waters.

Smreczyński's (1954) records of the occurrence of *M. minutissima* (L.) are indeed referring to *M. poweri* (Dgl. Sc.). I found this having examined his material.

I have already mentioned (p. 251) *M. perplexa* Horv. as being the macropterous form of *M. poweri* (Dgl. Sc.). The identification is not absolutely certain since the three „types" are ♀♀ and all very pale. Nevertheless, all available characters, such as the more convex posterior margin of the pronotum, bordered with a light yellow stripe, the stout appearance, and finally all proportions agreeing best with those of *M. poweri* (Dgl. Sc.), make their identity with this species most probable.

The identity of *M. borealis* Lundblad with *M. poweri* (Dgl. Sc.), proved by Walton (1938), is now quite obvious.

As regards *M. macrothoracica* JORDAN, it is stated in the description (JORDAN, 1943, p. 238) that the specimens were macropterous („Die Flügel sind bei allen Exemplaren gut entwickelt.") and this is perfectly obvious from the excellent figure. It is absolutely sure that it represents *M. poweri* (DGL. SC.) as the parameres are quite typical for this species. The resemblance of the right paramere on fig. 4 and that of POISSON (1938, fig. 41 C) is striking. Another evidence of identity would be the shape of the lateral tongue of the fifth tergite in the ♂♂ (prestrigilar flap); unfortunately JORDAN (1943) disregards this feature. All differences stated by him between *M. macrothoracica* JORDAN and *M. perplexa* HORV. (it should be recalled that JORDAN examined HORVÁTH's specimens from the Museum of Budapest) are so distinct, because when comparing he took into account mainly macropterous specimens of *M. griseola* HORV., determined by HORVÁTH as *M. perplexa* HORV. as well (see p. 294).

M. cornuta WAGNER is mentioned last in my synonymic list of *M. poweri* (DGL. SC.). WAGNER himself (1952, p. 27) stressed its affinity to *M. poweri* (DGL. SC.), and in my opinion there is no doubt whatever about their identity. The hump on the posterior margin of the head or rather a keel or vault-like elevation (important in respiration) is present in every species of *Micronecta* KIRK. known to me. Its greater projection in *M. cornuta* WAGNER may be caused by a contraction of the vertex which is common, especially when specimens taken freshly after ecdysis are killed and dried. Other differences, particularly in the parameres are of little value. The apex of the right paramere has in my material of *M. poweri* (DGL. SC.) just such a shape as that which WAGNER (1952) attributes to *M. cornuta* WAGNER. He is not right either when denying the presence of a protuberance at the tip of the left paramere in *M. poweri* (DGL. SC.). The paleness of *M. cornuta* WAGNER is also of minor value as a difference, since there are in *M. poweri* (DGL. SC.) specimens with an almost complete reduction of the dark pattern, and there may be found also transitional ones between the palest and the darkest specimens. Lastly the small size is normal for the members of the summer generation of *M. poweri* (DGL. SC.), especially

those living in lakes, and WAGNER's (1952) specimens of *M. cornuta* WAGNER are not only from a lake (Tollense-See), but were also collected on August 12, 1936, and must belong therefore to the summer generation.

Finally I have to correct my former determination of the specimens from the Żółwińskie Lake on the Wolin-Island as *M. poweri* (DGL. SC.) (WRÓBLEWSKI, 1952). When recently reexamined they proved to be *M. griseola* HORV. My error was caused by a misinterpretation of the differences between *M. minutissima* (L.) and *M. griseola* HORV. For an excuse I may say, that while writing (in 1948) I could not obtain the necessary literature, and the paper of POISSON (1938) was unknown to me.

List of finds

Province Gdańsk. Distr. Wejherowo: Żarnowieckie Lake, 14 VII 1936, 59 ♂♂, 161 ♀♀ (1 ♀ macropterous); 13 V 1954, 116 ♂♂. Distr. Kartuzy: Patuły Lake, 1 VI 1954, 109 ♂♂. Dąbrowa Lake, 1 VI 1954, 12 ♂♂. Lubowisko Lake, 1 VI 1954, 13 ♂♂, 1 ♀. Stasiczno Lake, 1 VI 1954, 34 ♂♂. Stężyca, Raduńskie Lake, 1 VI 1954, 3 ♂♂. Distr. Kościerzyna: Kościerzyna, the brook, 2 VI 1954, 3 ♂♂, 1 ♀. Kotel Lake, 2 VI 1954, 10 ♂♂, 7 ♀♀. Olpuch, little lake, 2 VI 1954, 3 ♂♂, 1 ♀. Wdzydze Lake, near Olpuch, 2 VI 1954, 3 ♂♂.

Province Bydgoszcz. Distr. Chojnice: Kosobudy Lake, 3 VI 1954, 55 ♂♂, 2 ♀♀. The brook affluent to the Dybszk Lake, 3 VI 1954, 16 ♂♂. Brda River between Łońsk Lake and Dybszk Lake, 3 VI 1954, 8 ♂♂, 1 ♀. The lake E from Swornegacie, 3 VI 1954, 4 ♂♂, 18 ♀♀. Swornegacie, the lake in the forest, 3 VI 1954, 1 ♂, 3 ♀♀. Charzykowo Lake, 3 VI 1954, 3 ♂♂.

Province Szczecin. Distr. Gryfino: Miedwie Lake, 11 VIII 1953, 4 ♂♂; 11 VI 1954, 2 ♂♂. Distr. Choszczno: Klukom Lake, 11 VI 1954, 10 ♂♂, 10 ♀♀.

Province Koszalin. Distr. Drawsko: Wilczkowo Lake, 5 VI 1954, 13 ♂♂, 34 ♀♀. Distr. Szczecinek: Drawsko Lake, 5 VI 1954, 17 ♂♂, 17 ♀♀. Trzesiecko Lake, 4 VI 1954, 10 ♂♂, 6 ♀♀. The outflow of Trzesiecko Lake, 4 VI 1954, 5 ♂♂, 12 ♀♀. Wielimie Lake, 4 VI 1954, 36 ♂♂, 14 ♀♀.

Province Olsztyn. Distr. Węgorzewo: Przystań, Mamry Lake, 12 VIII 1949, 7 ♂♂, 5 ♀♀; 16 VIII 1953, 44 ♂♂, 77 ♀♀, leg. J. JASKOWSKA. Distr. Giżycko: Kisajny Lake, 30 V 1954, 19 ♂♂, leg. A. TSCHUSCHKE. Tajty Lake, 30 V 1954, 82 ♂♂, 7 ♀♀, leg. A. TSCHUSCHKE. Distr. Mrągowo: Mikołajki Lake, 28 VIII 1953, 5 ♂♂, 4 ♀♀, leg. J. JASKOWSKA; 20 VI

1954, 2 ♂♂, 14 ♀♀, leg. S. Kosicki. Śniardwy Lake, 26 V 1954, 13 ♂♂, leg. A. Tschuschke.

Province Białystok. Augustów: Necko Lake, 29 VIII 1953, 1 ♂. Białystok: Dolistówka Brook, 28 VII 1954, 28 ♂♂.

Province Poznań. Distr. Szamotuły: Mormin Lake, 16 V 1937, 6 ♂♂, 3 ♀♀. Distr. Oborniki: Murowana Goślina, the brook, 26 VIII 1954, 5 ♂♂, 4 ♀♀. Zielonka, the brook, 25 VII 1954, 9 ♂♂, 4 ♀♀; 11 VIII 1954, 5 ♂♂, 7 ♀♀; 23 VIII 1954, 8 ♂♂, 7 ♀♀; 27 VI 1955, 1 ♂, 4 ♀♀. Zielonka, the lake, 11 VIII 1954, 1 ♀. Distr. Poznań: Bogucin, Główna Rivulet, 17 VI 1954, 1 ♂, 3 ♀♀. Poznań-Karolin, the mill-pond, 28 V 1954, 15 ♂♂, 36 ♀♀; 7 VI 1954, 8 ♂♂, 5 ♀♀; 17 VI 1954, 2 ♂♂, 1 ♀; 24 VII 1954, 11 ♂♂, 3 ♀♀, leg. K. Skarżyńska; 9 VIII 1954, 6 ♂♂, 4 ♀♀; 21 VIII 1954, 3 ♂♂, 3 ♀♀. Poznań-Karolin, Główna Rivulet, 24 V 1954, 17 ♂♂, 3 ♀♀; 28 V 1954, 10 ♂♂, 14 ♀♀; 7 VI 1954, 2 ♂♂, 3 ♀♀; 17 VI 1954, 2 ♂♂, 2 ♀♀; 14 VII 1954, 1 ♂; 24 VII 1954, 4 ♂♂, 3 ♀♀; 9 VIII 1954, 3 ♂♂, 4 ♀♀; 21 VIII 1954, 3 ♂♂, 3 ♀♀; 2 IX 1954, 1 ♂. Poznań-Karolin, E clay-pond, 12 V 1953, 8 ♂♂, 5 ♀♀; 29 V 1953, 3 ♂♂, 2 ♀♀; 15 VII 1953, 2 ♂♂; 14 V 1954, 1 ♂; 16 V 1954, 35 ♂♂, 1 ♀; 20 V 1954, 23 ♂♂, 4 ♀♀; 24 V 1954, 4 ♂♂, 2 ♀♀; 28 V 1954, 1 ♂; 14 VII 1954, 3 ♂♂, 3 ♀♀; 24 VII 1954, 6 ♂♂; 9 VIII 1954, 3 ♂♂, 1 ♀; 2 IX 1954, 1 ♂; 22 V 1955, 8 ♂♂; 27 V 1955, 12 ♂♂, 6 ♀♀; 6 VI 1955, 3 ♂♂, 3 ♀♀. Distr. Kępno: Pisarzowice, the pond, 10 VI 1955, 2 ♂♂, 6 ♀♀, leg. L. Berger.

Province Łódź. Distr. Łowicz: Łowicz, Bzura River, 27 VII 1954, 1 ♂. Kalenica Brook, 27 VII 1954, 9 ♂♂, 4 ♀♀. Bobrówka Brook upstream from Okręt Pond, 27 VII 1954, 1 ♂, 14 ♀♀.

Province Kielce. Distr. Końskie: Niekłań, Czarna River, 4 VIII 1954, 2 ♂♂, 2 ♀♀ (1 ♀ macropterous), leg. E. Smoleńska.

Province Lublin. Lublin-Dziesiąta, Czerniejówka Rivulet, 31 VII 1954, 15 ♂♂, 15 ♀♀; 5 VI 1955, 1 ♀, leg. W. Zwolski.

Province Wrocław. Distr. Lubań: Gryfów, Kwisa River, 21 VI 1954, 1 ♂, 2 ♀♀. Gryfów, the right tributary of the Kwisa River, 21 VI 1954, 12 ♂♂, 21 ♀♀. Gryfów, a brook, 21 VI 1954, 2 ♂♂, 3 ♀♀. Distr. Jelenia Góra: Kamienica Stream upstream from the Pilchowickie Storage-lake, 20 VI 1954, 29 ♂♂, 45 ♀♀. Distr. Kłodzko: Kłodzko, the right tributary of the Nysa River, 23 VI 1954, 2 ♂♂, 7 ♀♀ (2 ♀♀ macropterous). Kłodzko, the mouth of a brook to the Nysa River, 22 VI 1954, 9 ♂♂, 3 ♀♀.

Province Kraków. Distr. Olkusz: Ojców, Prądnik Stream, 20 VI 1955, 4 ♂♂, 3 ♀♀, leg. Z. Pniewski. Distr. Nowy Targ: Przywarówka Streamlet near Babia Góra, 9 VII 1937, 12 ♂♂, 15 ♀♀ (2 ♀♀ macropterous). Szaflary, Dunajec River, 14 VII 1937, 7 ♂♂, 32 ♀♀ (1 ♀ macropterous); 24 VII 1953, 8 ♂♂, 16 ♀♀ (1 ♀ macropterous), leg. J. Serafińska. Szaflary a tributary of the Dunajec River, 24 VII 1953, 4 ♂♂, 23 ♀♀ (2 ♀♀ macropterous), leg. J. Serafińska. Trybsz, a streamlet tributary of the Białka River, 17 VII 1937, 1 ♂, 27 ♀♀ (4 ♀♀ macropterous). Distr. Nowy Sącz: Dąbrówka, Poprad River, 6 VIII 1954, 1 ♂. Barcice, a streamlet, 6 VIII 1954, 2 ♀♀ (both macropterous). Barcice, a brook flowing out

from a quarry, 6 VIII 1954, 3 ♂♂, 6 ♀♀. Rytro, Poprad River, 6 VIII 1954, 2 ♂♂, 1 ♀. Rytro, a streamlet, left tributary of the Poprad River, 6 VIII 1954, 4 ♂♂, 17 ♀♀.

Province Rzeszów. Distr. Jasło: Jasło, Wisłoka Stream, 17 VI 1955, 1 ♂ (macropterous), leg. Z. Pniewski. Żółków, Wisłoka Stream, 18 VI 1955, 1 ♂, 1 ♀ (both macropterous), leg. Z. Pniewski. Żmigród Nowy, Wisłoka Stream, 18 VI 1955, 1 ♂, leg. Z. Pniewski. Żmigród Nowy, a right tributary of the Wisłoka Stream, 18 VI 1955, 18 ♂♂, 4 ♀♀, leg. Z. Pniewski. Żmigród Nowy, a spring brook, 18 VI 1955, 3 ♂♂, 1 ♀, leg. Z. Pniewski. Kąty, Wisłoka Stream, 18 VI 1955, 3 ♂♂, 7 ♀♀ (4 ♀♀ macropterous), leg. Z. Pniewski. Kąty, a tributary of the Wisłoka Stream, 18 VI 1954, 11 ♂♂, 8 ♀♀, leg. Z. Pniewski. Krępna, Wisłoka Stream, 18 VIII 1955, 9 ♂♂, 39 ♀♀ (1 ♀ macropterous). Krępna, a streamlet, left tributary of the Wisłoka Stream, 19 VIII 1955, 2 ♂♂, 13 ♀♀ (1 ♀ macropterous). Krępna, a streamlet, right tributary of the Wisłoka Stream, 18 VIII 1955, 2 ♀♀ (both macropterous). Distr. Sanok: Zagórz, San River, 4 VIII 1954, 3 ♂♂, 5 ♀♀.

Ecology

My whole material of *M. poweri* (Dgl. Sc.) consists of 1163 ♂♂ (2 macropterous) and 890 ♀♀ (26 macropterous) collected in 107 samples from 71 habitats. The prevailance of the ♂♂ over the ♀♀ in general numbers is here no phenomenon peculiar to the species as it is in the case of *M. minutissima* (L.). It is simply the result of many and abundant samples having been collected just at the time of the spring generation's first appearance. The ♀♀, the appearance of which is always a few days delayed, were thus completely missing in several of the samples, in others they were but few. Most of the habitats are running waters, especially mountain streams (12) and streamlets (12), then rivulets and rivers of the lowlands (17). In the lake districts of Pomorze and Mazury *M. poweri* (Dgl. Sc.) is quite often the inhabitant of lakes (27). In Great Poland's lowland the Lake Mormin, once the only known habitat of this species (Wróblewski, 1939 b) is its habitat no more. As less typical habitats may be mentioned the E clay-pond at Poznań-Karolin, a mill-pond and a neglected fish-pond. All of them are connected with rivulets or brooks.

At 34 habitats *M. poweri* (Dgl. Sc.) was found as the only member of the genus; these were lakes (10), mountain streams (5), and streamlets (9), rivulets (5) and brooks (4) of the

lowlands and finally the afore mentioned fish-pond. At the remaining habitats it was accompanied by other species, mostly by *M. griseola* Horv., which in 26 cases was the only companion observed and in 10 of them the numerically predominant. In two lakes *M. poweri* (Dgl. Sc.) occurred together with *M. minutissima* (L.); both these species I also found in a sample, collected by E. Smoleńska in the Czarna Streamlet (near Kielce). In three lakes and a mill-pond I found an association of all the 3 species mentioned, and in the E clay-pond at Karolin besides these *M. meridionalis* (Costa) as well. In the Wisłoka Stream, upstream from Jasło *M. poweri* (Dgl. Sc.) sometimes occurs in company with *M. carpatica* sp. n.

Among several factors indispensable for *M. poweri* (Dgl. Sc.) sufficient oxygen content in the water is more important than in other Polish species of *Micronecta* Kirk. This considerable oxygen demand may be best satisfied in well aerified waters of mountain streams and their tributaries, and in suitable rivulets and brooks in the lowlands. Moreover, the lakes of Pomorze and Mazury inhabited by this species are more oligotrophic, better saturated with oxygen than is the case in the Great Poland's eutrophic lakes, which are apparently unfit for it, as e. g. the Mormin Lake.

The occurrence of *M. poweri* (Dgl. Sc.) in running waters is mostly local, the species assembles often near water-falls (beneath them), at mouths of tributaries, in the neighbourhood of bridges and in various quiet recesses. But it is often difficult to foresee the place, and usually one has to travel long distances up or down the stream to find a point inhabited by this species.

It is certainly the habit of migrations of *M. poweri* (Dgl. Sc.) which, besides its gregarious instinct, is responsible for these local assemblages. The following observations indicate that the migrations actually take place. In the E clay-pond (Poznań-Karolin) two weeks after the spring appearance of adults there is always visible a rapid decrease in the number of specimens of *M. poweri* (Dgl. Sc.), and soon the species disappears entirely. At the same time the population of this species in the Główna Rivulet, adjacent and connected with

the pond [Map 6], increases distinctly, and the species remains there afterwards, without sensible changes in abundance. This is a rather obvious consequence of the emigration from the clay-pond, which is used merely as a breeding place. The migration itself I have observed at another habitat. On June 27, 1955, in the brook at Zielonka (Distr. Oborniki) a specimen swimming upstream caught my attention. During half an hour, while I stayed there watching, four other specimens passed this place, advancing up the current. They proved to be 1 ♂ and 4 ♀♀ of *M. poweri* (Dgl. Sc.). The current being rapid, they kept close to the water's edge, rushing for distances of 10—15 cm and then stopping for a few seconds after every swim. Macropterous specimens of *M. poweri* (Dgl. Sc.) undertake also certainly migrations on wings as do all other Polish species of the genus. Proving this are some catches of macropterous specimens at stations where brachypterous were absent. According to the principle formerly explained (p. 264) autochthonous macropterous should only be considered as such when occurring together with brachypterous specimens of the same species.

As to the occurrence of the macropterous form of *M. poweri* (Dgl. Sc.) it is very characteristic that apart from a single ♀ specimen from the Żarnowieckie Lake, all others were caught in running waters and in particular in mountain streams and streamlets. It may be caused by some ecological factors influencing the early larval stages, or we may be dealing here with an inclination, possibly a hereditary one, to develop this atavistic form more often. Such disposition is very profitable for this species living in the difficult and often perilous conditions of the mountain waters. While the macropterous ♀♀ of this species are fairly common, especially in the mountain tributaries of the Wisła River, the ♂♂ are exceedingly rare. The only two ♂♂ of my material were caught in the Wisłoka Stream. No wonder that also the types of *M. perplexa* Horv. are two ♀♀. Only Jordan (1943) was successful enough, having found the ♂♂, though in scanty number too (5 ♂♂ to 36 ♀♀). Walton (1938), as said above, has mistaken the brachypterous ♂♂ for macropterous ones.

Development

The larval development of *M. poweri* (Dgl. Sc.) was described by Walton (1938) and at the same time by Berg (1938), his „*M. minutissima*" being really (Leth, 1943) *M. poweri* (Dgl. Sc.). Both descriptions are not exact enough, and Walton's data are sometimes dubious. My observations too, are far from being complete. The study of young larvae in natural conditions is rendered difficult by their great resemblance to those of the other species accompanying them; such habitats where *M. poweri* (Dgl. Sc.) occurs as the only species, are situated too far away from Poznań to maintain continual observations on them. My records are taken chiefly from laboratory breeding and as such should be treated with criticism. The conditions of breeding, differing in several regards from the natural ones, must influence the development, rendering the observations less comparable.

In a microaquarium (a Petri dish of 40 cm^3) from eggs laid about June 12, 1955, three larvae hatched after 16—18 days. Two of them died, the third underwent the first ecdysis on the 17th day. It remained in the second stage 15 days, in the third about 20 days and between 20 and 24 of August it reached the fourth stage. In this stage the larva remained unchanged till November when it died.

In the table below are shown the dimensions of the larvae in mm

Stage		I	II	III	IV	V
Specimen bred	Length	0,57	0,71	1—1,06	1,32—1,37	—
	Breadth	0,29	0,43	0,62	0,81	—
Larvae from	Length	—	—	0,97—1,16	1,32—1,52	1,6 —1,92
natural habitats	Breadth	—	—	0,51—0,63	0,66—0,83	0,94—1,2
Walton, 1938	Length	0,62	0,8	0,92	1,08	1,5
	Breadth	0,32	0,47	0,54	0,65	1

As it can be seen, Walton's (1938) dimensions, in particular the lengths of the older stages differ greatly, and seem even wrong. According to my experience the nymphs (fifth stage) have on the average a length at the most by 10 per cent smaller than the adult specimens. Therefore, if the imagines were 2 mm long (in the case of Walton, 1938) the nymphs should

measure 1,8 mm or more, while the dimension given by WALTON is but 1,5 mm. He seems to have confused the stages, the fifth is certainly missing. BERG (1938) does not mention the dimensions in numbers, but the values resulting from the illustrations are in the first stages nearer to WALTON's (1938), the remainder, however, rather approach my averages as observed in natural habitats.

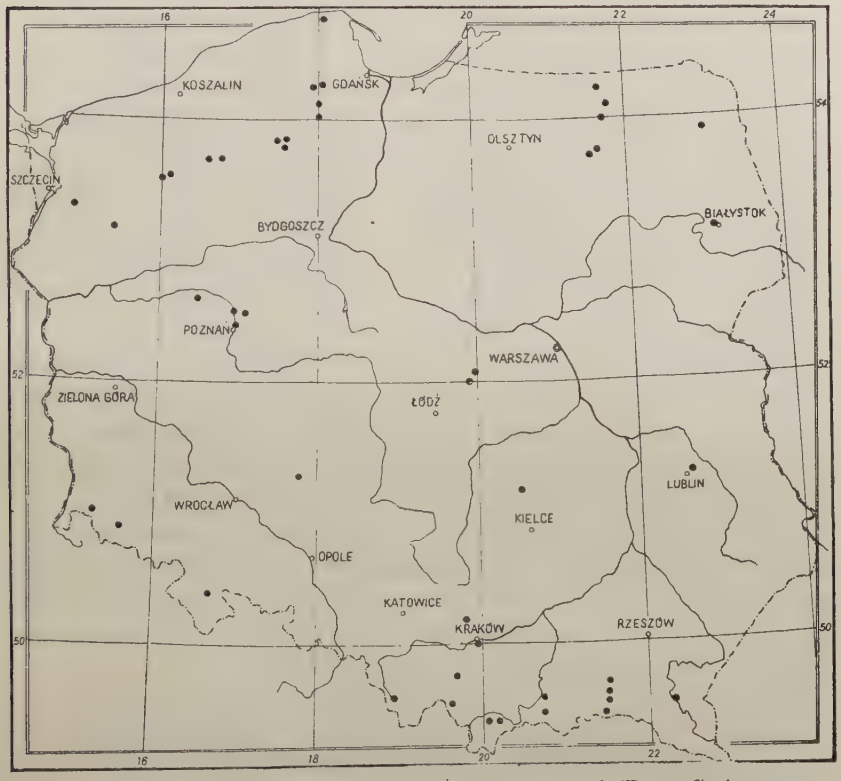
WALTON (1938) admits the third stage as the hibernating one, while BERG (1938) observed in Esrom Lake larvae about 1,4 mm long (evidently of the fourth stage) as the only ones occurring from the middle of September till May. My experience of the breeding as well as observations in natural conditions lead me to believe, that like in the other species in *M. poweri* (DGL. SC.) the larvae are mainly hibernating in the fourth stage. This stage is reached in late summer or early autumn by most larvae hatched from eggs laid since the middle of June. Some of the larvae, however, hatched from the last laid eggs, remain in the third stage during the winter. In a sample from Raduńskie Lake (Distr. Kartuzy), taken on June 1, 1954, I found apart from the first adults (3 ♂♂) and prevailing nymphs (13), two larvae still in the fourth stage and one even in the third. The exceptional diversity of the sample suggests the possibility of hibernating of even younger stages, though it may be explained otherwise too. While adult specimens of *Micronecta* KIRK. respiring partly atmospheric air rather keep to the shallows of the shore, the larvae, especially those in the youngest stages, descend readily to the deeper zones of the bottom. They seem to be almost indifferent to the water-depth as they are capable only of cutaneous respiration, their body being very flattened, and transparent. *M. poweri* (DGL. SC.) is the only species of the genus about the vertical distribution of which in lakes there exist some data. BERG (1938) found in winter samples from the Esrom Lake larvae of this species mainly at a depth of 2 m, but he remarked that sporadically they may be found in the deeper littoral, up to 5 m. According to BRUNDIN (1949) the species (of course the larvae) inhabits the bottom even at a greater depth, 7 m, and an exceptional specimen was caught at 11,5 m.

In the mentioned sample from the Raduńskie Lake the larvae in the third and fourth stages may have been such specimens which having hibernated far from the shore, at a great depth and thus in water having a much lower temperature in spring, remained for a longer time unchanged. When finally they approached the shore so as to continue their development in warmer water, there were present also their fellows which already became nymphs or even adults, because they have passed the winter in a shallower littoral, and they began their development in spring some weeks earlier.

The first imagines in 1954, in the E clay-pond at Karolin appeared on May 14, that is 5—6 days before *M. griseola* Horv. and *M. minutissima* (L.). The ♂♂ preceeded the ♀♀ too. The time of appearance depends of course on climatic factors and on the depth of the water. In the warmer spring of 1953, in the same clay-pond on May 12 the species was wholly developed, the ♀♀ included, while in 1955 the prolonged frosts delayed the development, and May 22 was the date of the appearance of the first ♂♂. In the Żarnowieckie Lake, the most northern Polish habitat of *M. poweri* (Dgl. Sc.), its appearance in 1954 was about two weeks later than in the E clay-pond at Karolin. In the deep Wdzydze Lake (Distr. Kościerzyna) it was more delayed, and still more in some deeper lakes of the Mazury Region. The time of adults' appearance in the Esrom Lake, which according to Berg (1938) is the end of June, seems to me much too late, and therefore rather dubious. It is more probable that it may be the beginning of the second, — the summer generation.

Walton (1938), as well as Berg (1938), admit the occurrence of one generation only. The experience of my breeding rather confirms this belief. The development of the eggs and the first three stages lasted more than two months and the fourth stage began as late as the end of August. According to Berg (1938) the development in the Esrom Lake lasted still longer (by two weeks), though the duration of the first stage of four weeks seems to me improbable. Nevertheless, the development of *M. poweri* (Dgl. Sc.) certainly lasts longer than in the other Polish species of the genus, especially in the conditions of mountain waters; therefore, in a great part

of the Polish habitats, I suppose, only one generation may develop during the year. On the other hand in several lakes of Pomorze and even of Mazury, and above all in the running waters of our lowlands, the occurrence of a second generation should be regarded as normal. At least a part of the larvae hatched from the earliest laid eggs is surely able to develop fully, and to become adult in the same year. The members of the summer generation differ by their smaller size; they are usually less abundant too.



Map 4. Polish stations of *Micronecta poweri* (DGL. SC.).

Geographical distribution

The dispersal of the habitats of *M. poweri* (DGL. SC.) in Poland is characteristic, and it was already discussed as dependent on their ecology. There are two distinct zones in which

the habitats are more frequent: the northern, including the Lake-Regions of Pomorze and Mazury with a disjunction extending from the river Wisła eastwards as far as the Śniardwy Lake, and the southern, consisting of lands at the foot of the Sudety and the Karpaty Mountains. The less apparent Silesian disconnection I tried already to explain.

The distribution of this species outside Poland is better known than that of the other members of the genus *Micronecta* Kirk. It occurs in France (Poisson, 1938), in the British Isles (Douglas and Scott, 1869, Walton, 1938), in Denmark (Leth, 1943), Germany (Wróblewski, 1939 b, Jordan, 1943, Wagner, 1952), in Sweden (Lundblad, 1936), Finland (Linnavuori, 1951), in the European part of the USSR (Kiričenko, 1951) and in Italy (Tamanini, 1948). Having examined Horváth's material from the Museum of Budapest I am able to add Switzerland (Verndyaz), Austria (locality unmentioned), Czechoslovakia (Kéžmark), and Hungary (Czikud, Garamszentbenedek). The species may be expected to occur in some other European countries too, should also be found in the Balcan Peninsula.

Although its area of distribution extends so far southwards (Pyrénées; Abruzzi) *M. poweri* (Dgl. Sc.) is undoubtedly the most northern of the European species of the genus. The name „*borealis*" given by Lundblad (1936) expressed it accurately. The frequency of this species increases in the north quite apparently, or when approaching mountains. Its advanced spring appearance, when compared with other species, is surely too a proof of its northern character. The development of *M. poweri* (Dgl. Sc.) begins earlier, when the water is still too cold for the other species.

5. ***Micronecta carpatica*** sp. n.

Brachypterous form seen from above elliptical in outline [Textfig. 16]. The average length is in the ♂♂ 1,697 mm, in the ♀♀ 1,713 mm, and fluctuates between 1,57 and 1,83 mm, in both sexes equally. Sexual dimorphism in size almost imperceptible; somewhat more distinct are the seasonal differences. The ♂♂ collected in June reach on the average 1,703 mm and the ♀♀

even 1,75 mm, while the specimens found in August measure 1,67 mm, alike in both sexes. Minimum breadth of the body 0,858 mm, maximum 0,987 mm. The body-length to breadth ratio in the ♂♂ 1,871 (1,727—2), in the ♀♀ 1,867 (1,774—2,033); its average value is even less than in *M. meridionalis* (Costa), *M. carpatica* sp. n. is thus the least elongated among our species of the genus.

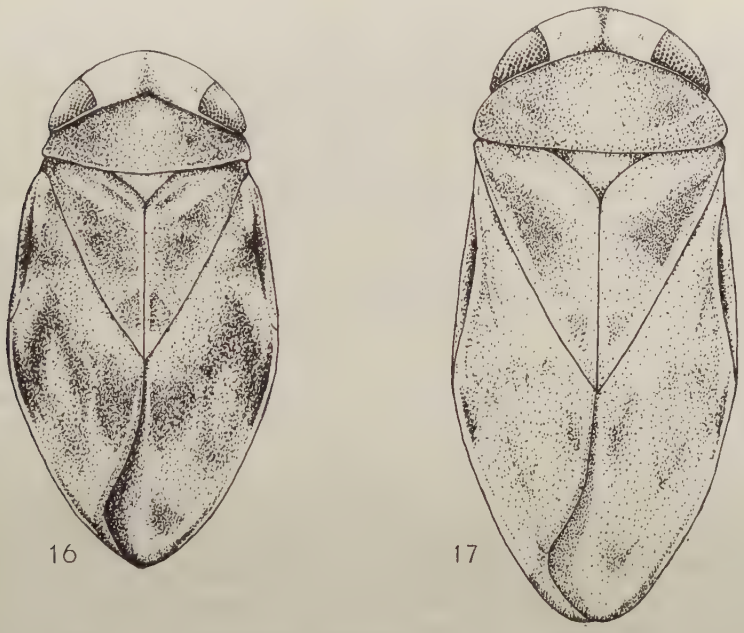


Fig. 16 and 17. *Micronecta carpatica* sp. n. 16. Brachypterous ♀. 17. Macropterous ♂. Both from Wisłoka Stream (Jasło), 17 VI 1955, leg. Z. Pniewski.

The head in general resembles that of *M. griseola* Horv., its breadth averages 0,66 (0,615—0,692) mm in the ♂♂ and 0,665 (0,634—0,709) mm in the ♀♀, and is always less than the breadth of the pronotum. Vertex in the middle a little longer than near the eyes. The synthlipsis is on the average 1,744 (1,594—2) times wider than the eye-breadth in the ♂♂, and 1,764 (1,538—2) times in the ♀♀. In the value of this ratio the new species is intermediate between *M. poweri* (Dgl. Sc.) and *M. griseola* Horv. Along the middle of the vertex runs

a brown stripe, better visible in darker specimens. There are also the lateral spots near the eyes. The antennae do not show any conspicuous characters particular to this species. The length of their joints in mm is as follows[1]:

	♂♂	♀♀
I	0,064 (0,057—0,074)	0,065 (0,057—0,085)
II	0,035 (0,028—0,038)	0,038 (0,03—0,044)
III	0,129 (0,114—0,141)	0,129 (0,11—0,144)

Pronotum broader than the head by on the average 2,5 per cent of the head-breadth. It is in the ♂♂ 3,27 (2,75—3,615) times as wide as long and in the ♀♀ 3,23 (2,9—3,53) times. This value, being greater than in the other Polish species of the „*minutissima*"-group is characteristic for *M. carpatica* sp. n. The posterior margin of the pronotum is only slightly convex, often nearly straight. In the middle of the anterior margin a very small tubercle, like in *M. griseola* Horv., pale in colour, while the rest of the pronotum is of a dull sandy yellow.

The hemielytra have a wedge-like outline, narrowing towards the membranes. Their surface is mat, the pubescence scanty, resembling that of *M. griseola* Horv. in the shortness and arrangement of the hairs. The hemielytra of all my specimens are light sandy-yellow, opaque, the black larval dorsal glands scarcely shining through. The dark pattern, mostly fading, is only in a few specimens somewhat more visible, and then it resembles that of *M. poweri* (Dgl. Sc.), showing the transversal zigzag stripe across the middle of the corium; the outlines of the blotches are dim. The basal angle of the corium and the embolium near by are darkened too. In the darkest specimen, shown on textfig. 16, can be traced the V-like mark in the apical part of the corium, the shadows on the clavus (apart from the larval glands shining through) and the spot on the right membrane.

The wings in the brachypterous form of *M. carpatica* sp. n. are reduced to almost the same degree as in *M. poweri* (Dgl. Sc.), hardly reaching the middle of the sixth abdominal

[1] 13 ♂♂ and 8 ♀♀ measured.

tergite. Their length averages about 63,5 (61—70) per cent of the length of the hemielytra.

Anterior legs of the ♂♂ (13 specimens measured):

Average length in mm		Length relatively to femur-length
Femur	0,255	100
Tibia	0,149	58,77 (53,33—64,39)
Pala	0,17	66,65 (60,3—74,19)
Claw	0,098	38,47 (33,33—41,54)

The femur-length averages 14,98 per cent of the body-length in the ♂♂; in the ♀♀ the mean length of the femur is 0,231 mm, of the tibio-pala 0,236 mm. The ratios in the joint-lengths are very similar to those of *M. griseola* Horv. In the shape of the ♂♂ pala there is nothing distinctly peculiar to this species.

Middle legs[1]:

Average length in mm			Length relatively to femur-length	
	♂♂	♀♀	♂♂	♀♀
Femur	0,607	0,604	100	100
Tibia	0,227	0,23	37,43 (34,44—40,46)	38,03 (34,34—40,73)
Tarsus	0,327	0,321	53,94 (51,54—56,41)	53,19 (50,29—55,62)
Claws	0,204	0,196	33,61 (29,61—36,18)	32,51 (30,53—35,1)

Excepting the claws, which are relatively shorter than in all our other species, the ratios approach here *M. poweri* (Dgl. Sc.). The tarsi are 1,61 (1,48—1,84) times as long as the claws in the ♂♂ and 1,64 (1,58—1,8) times in the ♀♀. The femur-length amounts to 35,8 (34,7—37) per cent of the body-length in the ♂♂ and to 34,5 (33,2—36,8) per cent in the ♀♀.

Posterior legs[1]:

Average length in mm			Length relatively to femur-length	
	♂♂	♀♀	♂♂	♀♀
Femur	0,445	0,448	100	100
Tibia	0,338	0,341	76,04 (71,9—80,5)	76,25 (71,42—78,93)
Tarsus I	0,352	0,355	79,19 (73,74—83,12)	79,19 (76,65—83,03)
Tarsus II	0,153	0,161	34,4 (32,45—37,5)	35,92 (34,5—38,17)
Claw	0,121	0,118	27,21 (24,68—29,91)	26,41 (24,68—29,44)

[1] 13 ♂♂ and 8 ♀♀ measured.

The femur-length is on the average 26,3 (25,4—27,3) per cent of the body-length in the ♂♂ and 25,6 (24,6—26,6) per cent in the ♀♀, the femur is also relatively longer than in our other species of *Micronecta* KIRK., the tibia, however, is somewhat shorter.

The abdominal tergites of the ♂♂ are pale brown, the basal sternites yellow, with an orange tint, the fourth and fifth brownish (often in the middle parts only), the distal sternites are of a straw-yellow colour. Pale are also the dorsal and ventral sides of the abdomen in the ♀♀. The lateral tongue of the fifth tergite (prestrigilar flap) of the ♂♂ [Pl. XXVII, fig. 75, 76] approaches that of *M. minutissima* (L.) in its outline, having a rounded apex. It is however more regular, constant in shape and more bent inwards. Also the free lobe of the eighth segment [Pl. XXVII, fig. 77, 78] is in the ♂♂ of *M. carpatica* sp. n. characteristic. The outer, setigerous margin passes at a right angle into the posterior margin, which is straight at first, and then passes through a semicircle into the third — inner margin which is slightly concave.

The most reliable characters provides the right paramere of the ♂♂ [Pl. XXVII, fig. 67—69]. Its free portion is narrow immediately from the base and for $^2/_3$ of its length it runs straight, then turns at an angle of about 130°; the tip is often a little bent backward. From the base to the tip the paramere narrows almost evenly. The nose-like protuberance on the inner margin of the base is very low, contrary to that of our other species of the „*minutissima*"-group. The left paramere [Pl. XXVII, fig. 70—74], less peculiar, resembles on the whole that of *M. griseola* HORV., though its style is much more elongated, and more bowed The slant ridge near the tip is narrower and hardly, if ever, protruding laterally. Beneath it there may often be seen a shallow incision.

In most morphological details the small extent of variation is striking. It is perhaps in some degree the consequence of the uniformity of the habitat's conditions, but it seems to prove the homogenity of the population in the Wisłoka Stream as well.

The macropterous form [Textfig. 17] is more elongated and parallel-sided like in the other species of *Micronecta* KIRK.

In my 5 specimens of this form, the only which I was able to collect, the dimensions in mm are as follows:

	♂♂			♀♀	
Length	2,031	2,059	2,059	1,945	2,031
Breadth	0,944	0,972	0,915	0,915	0,972

The length to breadth ratio of all these specimens (average 2,146) does not differ from that in the other species of the „*minutissima*"-group, contrary to the same ratio in the brachypterous form, which is in *M. carpatica* sp. n. distinctly smaller. The head seen from above has also the delusive appearance of being shorter than in the brachypterous form, which is the result of its being more bent down, pressed forward by the longer pronotum. The synthlipsis to eye-breadth ratio is in the ♂♂ 1,742 and 1,846, in the ♀♀ 1,692 and 1,769. The pronotum is much broader than the head, as always in the macropterous form; in this species by 15,94 per cent of the head-breadth on the average. The length of the pronotum is 0,31—0,34 mm, its breadth is in the ♂♂ 2,417 and 2,522, in the ♀♀ 2,348 and 2,679 times its length. The average of this ratio, 2,47, is almost the same as in *M. griseola* HORV. and *M. poweri* (DGL. SC.). The posterior margin of the pronotum is but slightly convex. The hemielytra are nearly parallel-sided, the membranes being well developed. The coloration does not differ from that of the brachypterous form; all my macropterous specimens are pale with only traces of a dark pattern.

Holotype: brachypterous male, allotypes brachypterous female and macropterous male, all from the Wisłoka Stream at Jasło, collected on June 17, 1955, by Z. PNIEWSKI. The holotype and both allotypes, dissected and mounted as microscopical preparations, are kept at the Zoological Institute of the Polish Academy of Science, Branch at Poznań.

As to the affinity of *M. carpatica* sp. n. it can not be immediately connected with any other European species known at present. Least of all it is related to *M. meridionalis* (COSTA), although the two species have in common the relatively great breadth of the body, the shortness of the pronotum and the narrowness of the right paramere. *M. carpatica* sp. n. belongs

quite definitely to the „*minutissima*"-group judging by most proportions, by the pubescence of the hemielytra, and several characters of the abdomen structure, and above all by the shape of the parameres of the ♂♂. The left one shows some general connection with *M. griseola* Horv. though it is much more slender. An evident resemblance may be observed with *M. wui kashmirica* Hutchinson (1940, fig. 47—49). This likeness, however, seems to be the result of convergence, and the new species does not belong to *M. wui* Lundblad quite certainly. *M. carpatica* sp. n. may descend from some ancestor common to *M. poweri* (Dgl. Sc.) and also to *M. wui* Lundblad (both these species being closely related), but there must have been transitory forms like such species as *M. hummeli* Lundblad (1934) or some other unknown at present. The latter species happens to have the right paramere distinctly intermediate between that of *M. poweri* (Dgl. Sc.) and *M. carpatica* sp. n. The free portion of this paramere is in *M. hummeli* Lundblad swollen as in *M. poweri* (Dgl. Sc.) but the apical part resembles that of *M. carpatica* sp. n.

List of finds

Province Rzeszów. Distr. Jasło: Krępna, Wisłoka Stream, 18 VIII 1955, 1 ♂, 4 ♀♀; left tributary of the Wisłoka Stream, 18 VIII 1955, 1♂, 1 ♀ (♀ macropterous). Kąty, Wisłoka Stream, 18 VI 1955, 52 ♂♂, 28 ♀♀ (Pn)[1]. Nowy Żmigród, Wisłoka Stream, 18 VI 1955, 35 ♂♂, 24 ♀♀ (Pn); streamlet, right tributary of the Wisłoka Stream, 18 VI 1955, 8 ♂♂, 2 ♀♀ (Pn). Żółków, Wisłoka Stream, 18 VI 1955, 29 ♂♂, 10 ♀♀ (Pn); 19 VIII 1955, 2 ♂♂, 9 ♀♀. Jasło, Wisłoka Stream, 3 VIII 1954, 4 ♂♂, 12 ♀♀; 17 VI 1955, 58 ♂♂, 44 ♀♀ (3 ♂♂, 1 ♀ macropterous) (Pn).

Ecology

All my material of this species consists of 190 ♂♂ (3 macropterous) and 134 ♀♀ (2 macropterous) collected in 9 samples from 7 stations. The only habitats discovered till now are the Wisłoka Stream from Krępna down to Jasło and two of its small tributaries in the parts close to the mouths. In the bigger affluents, namely the Ropa and the Jasiołka Streams I did

[1] (Pn) means leg. Z. Pniewski.

not find this species. It was absent too in the Wisłoka down-stream from Jasło, in the immediate neighbourhood of this town as well as in the environs of Dębica and Mielec, where I looked specially for it. It is probable that the sewages of Jasło hinder the occurrence, and produce an impassable obstacle for this species.

The Wisłoka is from Jasło up-stream a typical mountain stream, with a stony or rocky bottom, a rapid current and clear water. Its breadth is at Jasło about 20 m, depth 0,5—1 m. Here and there the stony holms separate from the current more or less long bays with calm, warmer water. Such recesses and other niches at the back of big stones and rocks, in brief places, where the current slackens, or the water is almost stagnant, are most often inhabited by *M. carpatica* sp. n.

In 7 cases this species was accompanied by *M. poweri* (Dgl. Sc.), which was usually less numerous, and only in Krępna predominant. *M. griseola* Horv. occurred twice in the samples as single specimens. The character of the habitat, in which the new species occurs, suggests its rather high oxygen demand, which is at least equal to that of *M. poweri* (Dgl. Sc.). Quite apparent too is the sensibility of *M. carpatica* sp. n. to water pollution, common to all species of the genus.

Development

As my observations are very scarce, I can not say much on this subject. There is in the development of this species certainly much likeness to *M. poweri* (Dgl. Sc.) which lives in much the same conditions in mountain waters. Likewise the first yearly appearance of imagines is generally delayed, and its time varies in connection with local conditions, in particular with the average water temperature. While in 1955, at the stations near Jasło the first appearance took place probably about June 10 (on June 17 being almost completed), in the upper course of the Wisłoka Stream it was accordingly retarded. In a streamlet tributary at Nowy Żmigród, where the temperature was hardly 9°C, the appearance of adults on June 18, 1955, had just begun, and in the sample from

this habitat there were still 10 larvae of the fourth stage, 103 of the fifth stage and only 8 ♂♂ and 2 ♀♀ adults.

Rather dubious is also the occurrence of a second generation in the upper course of the Wisłoka, while in the lower course —near Jasło the summer generation was observed in 1954 as well as in 1955. I found there on August 3, 1954, apart from adults (of which some were freshly metamorphosed) more numerous nymphs quite ready to undergo the last ecdysis. I came across a state much resembling this on August 19, 1955. At the same time (18 VIII 1955) some 40 km upstream, at Krępna, there were only a few remnants of the first generation and not a single nymph (fifth stage) was observed. The presence of nymphs in August is a sure proof of the occurrence of a second generation. It is quite improbable that larvae which have hibernated could reach this stage so late. On the other hand, judging from the other species of the genus, there is time enough for the whole development, at least of the eggs laid in the middle of June. It should last in convenient conditions (even in mountain waters) about two months. As in our other species of *Micronecta* Kirk. the hibernating stage ought to be mainly the fourth. No known facts contradict this supposition.

Not having succeeded to get younger larvae, I am able to record only the dimensions of the last two stages. They are:

Stage	Length in mm	Breadth in mm
IV	1,35 (1,29—1,37)	0,7 (0,63—0,83)
V	1,61 (1,49—1,77)	0,98 (0,92—1,03)

The larvae of the new species may be distinguished from *M. poweri* (Dgl. Sc.), accompanying them sometimes, because they are smaller in size, more light in colour and have thinner (less sclerotised) exoskeletons.

About the geographical distribution nothing of course can be said. Further investigations will show, whether the occurrence of the new species is really limited to the upper course of the Wisłoka only. Very desirable would be searching in the Slovakian rivers, especially in the Ondava, the sources of which on the opposite side of the Karpaty Mountains are quite near to those of the Wisłoka. It seems highly probable that the new species inhabits more widely the tributaries of the Tissa

River, and passed the Karpaty Mountains, which near the Dukla Pass are low (502 m above sea-level). It seems possible

Map 5. Polish stations of *Micronecta carpatica* sp. n.

that the distance between the sources of the Wisłoka and the Ondava could be passed by macropterous specimens. If my supposition proves right, *M. carpatica* sp. n. could then be regarded as a species of probably Balcanic origin[1].

IV. NOTES ON THE VALUE OF THE CHARACTERS USED FOR IDENTIFICATION AND IN THE DESCRIPTIONS

Many of the criteria applied in the keys for the identification of the species of *Micronecta* KIRK. are of little value, often

[1] While this paper was in press I hadan opportunity to collect in this and in other Slovakian streams. My supposition proved to be right, and I found the new species not only in the Ondava, but also in the Topla and some of their tributaries.

misleading and sometimes making the determination difficult and uncertain. Some of them will be discussed below.

The comparison of the head- and of the pronotum-length introduced already by FIEBER (1860) is still used, in spite of LUNDBLAD's (1933) criticism. The head-length, and of course its relation to the pronotum-length is depending too much on the inclination of the head, and may greatly vary, especially in specimens preserved in alcohol which remain soft and flexible.

On the other hand it is advisable to use the ratio of the synthlipsis to the eye-breadth applied by LINNAVUORI (1951), which distinguishes easily, e. g. *M. minutissima* (L.) from *M. griseola* HORV. Its value in other species is also characteristic, though it is rather of less use in recognizing them; small differences are obscured often by considerable individual variation.

Notwithstanding the figures given by WAGNER (1952, fig. 37—40), I have not noticed in the shape of the antennal joints any characters more apparent and useful in the determination of our species, except in *M. meridionalis* (COSTA).

Quite common is in the descriptions of the pronotum the defining of the length of its lateral margins as a fraction of the length of the posterior margin of the eye. The pronotum having, however, mostly a spindle-shaped or almost semicircular outline and being never quadrilateral, there are no distinct lateral margins of it to measure. The distance between the basal angles of the pronotum and the head is unreliable too, especially when the material is preserved in alcohol and the heads are flexible. The ratio of the maximum breadth to the length of the pronotum is more characteristic only for some of our species, as for *M. meridionalis* (COSTA) and partly for *M. carpatica* sp. n.; its value varies too much. It must be recorded separately for the brachypterous and macropterous forms. In the latter the pronota are much larger and relatively longer, and allow the immediate recognition of macropterous specimens at a glance.

The dimensions of the scutellum mentioned sometimes in the descriptions are of minimal importance, at least in our species.

The hemielytra show usually important characters. Their dark pattern, when fully developed, is highly reliable in the determination, but very often it undergoes a more or less considerable reduction, sometimes fading almost entirely. It must be emphasized that the elements of the pattern are the same in all our species of the genus *Micronecta* Kirk. Characteristic of the dark blotches is their general tendency to shorten in some species while in others they remain more streaky. When shortening they also widen and eventually fuse together. The pattern and the coloration is as a rule more distinct in immersed specimens. Important also may be the appearance of the surface (shining or mat), the transparency, the pubescence, lastly the outlines of the hemielytra, which in our species are more or less parallel-sided, in some wedge-like, i. e. narrowing in the apical half. The subcostal groove („fossette subcostale"), recommended as a good character by Horváth (1899) and given in some descriptions, is a poor criterium, undiscernible even in the types of *M. capitata* Horv.

In the wing structure I have noticed no specific characters, save the degree of reduction different in the brachypterous specimens of the various species. A stronger reduction is correlated with the diminishing of the membranes and also with the more wedge-like outlines of the hemielytra.

In the descriptions of the legs either the average lengths of the parts or the ratios between them are usually made known. Of course the averages taken from numerous specimens are more reliable and still more valuable when the limits of variation are recorded. For comparison's sake it is very convenient to express the ratios of the lengths in relation to the femur-length, taking it as 100. Since the femur-length is variable too, it may be advisable to define it as a fraction of the body-length (e. g. in percentages). The expressing of the proportions in too round numbers, as applied by some authors is often misleading. Sometimes it blots out the small, though characteristic, differences. Sexual dimorphism in the legs is, apart from the fore-legs, scarcely visible, and considering the general variation, the slight differences may be neglected.

As to variation, a more marked is shown in the length of the anterior tibiae of the ♂♂. The length much depends on their

position. When flexed the tibiae become shorter, because their basal parts, less sclerotised, also bend thus seeming shorter. The length of the claws shows a real and relatively large variation, therefore the proportions between it and the other dimensions are of little practical importance. The ratio of the tarsus-length to the length of the claws in the middle legs, which is so useful in the identification of some *Corixinae*, has in the case of the Polish species of *Micronecta* KIRK. hardly any application. WAGNER (1952) used it in his key but with misleading results. The femurs show least variation, especially in the posterior legs. Their relative lengths are much the same in most Polish species. Only *M. meridionalis* (COSTA) shows in this point some peculiarities, which together with several other features stress the separate systematic position of this species in the genus. From among the species of the „*minutissima*"-group more characteristic is the greater length of the anterior tibiae in the ♂♂ of *M. poweri* (DGL. SC.), noticed already by LUNDBLAD (1936), although the ♂♂ of this species are sufficiently distinct without this criterium as well.

On the whole I must admit that I was disappointed at finding so little use in the relations of the joint-legths of the legs, computed with much cost of time and the even longer lasting measurements of a considerable number of specimens mounted in microscopical preparations. I expected to obtain characteristic formulae for every species, which would enable anyone to identify them, the ♀♀ included. I found instead that though there are some specific differences, they are almost insignificant considering their great variation. In the shape of the joints, even of the palae of the ♂♂, I have discovered no stable characters peculiar to the various species. Also neither in the number of the bristles and hairs nor in their shapes and their arrangement have I found any more distinct differences, *M. meridionalis* (COSTA) excepted.

In the descriptions of the abdominal structures there is often omitted the shape of the lateral tongue (prestrigilar flap) of the fifth tergite of the ♂♂. It is a pity, for its outline, though somewhat variable, is highly specific for each our species. HUTCHINSON (1940) indicates the reduction of the submarginal bristles on the right side of the fifth tergite as characteristic

for the ♂♂ of the „*minutissima*"-group. Some specimens of *M. poweri* (Dgl. Sc.) from the Mazury Region form exceptions in this respect, having the mentioned bristles more or less fully developed. The shape and the dimensions of the strigil in the ♂♂, depending on its position in microscopical preparation, do not present characters of more use in the identification of our species.

On the sixth and seventh abdominal sternites in both sexes may be found apart from hairs some longer bristles. Their number on the seventh is among others the basis for Hutchinson's (1940) subgeneric division of the genus *Micronecta* Kirk. To the species belonging to the subgenus *Micronecta* (*Micronecta*) Kirk. („*minutissima*"-group) this author ascribes 3—6 bristles on the seventh sternite. On the other hand *Micronecta* (*Dichaetonecta*) Hutch., to which *M. meridionalis* (Costa) belongs, is supposed to have only two bristles. I have discussed above (p. 262) the problematic value of these criteria as a basis for systematic division, here I wish to give my observations concerning the numbers of bristles found in the Polish species. *M. meridionalis* (Costa) shows in this respect a striking constancy, in all its specimens examined I have found two bristles on the seventh sternite. Relatively constant too is the number in *M. carpatica* sp. n. having almost always two bristles on the sixth sternite and on the seventh always four. The number in the remaining species varies greatly. Quite often they have four bristles on the sixth sternite and six on the seventh, but in 75 per cent there are various deviations, the greatest of them being the presence of three bristles on both sternites.

The seventh sternite of the ♂♂ has in the middle of its posterior margin an acute and asymmetrical projection, In the ♀♀ it is symmetrical, of trapezoidal or flatly semicircular outline. This process, usually characteristic, is omitted in the descriptions. The ♂♂ display several other characters more certain and distinct, but in the ♀♀, often lacking good criteria, the outline of this projection [Pl. XXVIII, fig. 79—100] may be of greater importance for identification. Especially in the ♀♀ of *M. poweri* (Dgl. Sc.) it can help in the recognition of this species, when other characters, e. g. those of coloration fail.

The shape of the free lobe of the eighth segment in the ♂♂ is often overestimated as a good character. It is only in *M. meridionalis* (Costa) and in *M. carpatica* sp. n. sufficiently peculiar and constant enough, to be reliable.

Undoubtedly the parameres of the ♂♂ provide the most infallible characters. Though their variation is considerable too, all our species, even those very similar to each other, may be always distinguished and quite surely identified by examining the parameres.

V. KEY FOR THE IDENTIFICATION OF THE POLISH SPECIES OF *MICRONECTA* Kirk.

A. Wings shortened, reaching at most to middle of seventh abdominal tergite. Body nearly twice as long as wide, of an elliptical outline. Pronotum small, a little broader than the head, or even narrower . . . . Brachypterous forms.

B. Wings fully developed, reaching to end of abdomen. Body more elongated, about 2,2 times as long as wide, its sides partly parallel. Pronotum large, very convex, mostly much broader than head. . . . . Macropterous forms.

A. Brachypterous forms

1. Pronotum less wide than head, nearly four times as wide as long. Hemielytra with shining surface, corium with dark pattern streaky, and with pubescence consisting of longer, erect, distinct, uniformly scattered hairs. Free lobe of eighth abdominal segment and parameres of ♂♂ as on fig. 1—11 [Pl. XXIII] . . . *M. meridionalis* (Costa).

—. Pronotum wider than head, about three times as wide as long. Pubescence on corium composed of short hairs, adherent. . . . . 2.

2. Synthlipsis about 1,5 times as wide as eye-breadth, vertex longer in middle than laterally, near eyes. Eyes big, cherry red. Hemielytra with shining surface, transparent; corium with dark pattern streaky, sometimes basal half of corium uniformly dark [Textfig. 11]. Lateral tongue of fifth abdominal tergite in ♂♂ with a rounded apex [Pl. XXIV, fig. 22]. Parameres of ♂♂ as on fig. 12—21 [Pl. XXIV] . . . . . *M. minutissima* (L.).

—. Synthlipsis 1,7—1,8 times as wide as eye-breadth. Hemielytra not shining, opaque; dark pattern of corium not streaky. . . . . 3.

3. Hemielytra narrowing distinctly in apical half. Pattern black or brown, sharply marked, well contrasting with light ground. In middle of corium dark blotches often melt together so as to form a zigzag-like transverse stripe. In ♂♂ lateral tongue of fifth abdominal tergite [Pl. XXVI, fig. 60] turned towards middle of segment, tapering and pointed. Parameres of ♂♂ as on fig. 47—59 [Pl. XXVI] . . . . . *M. poweri* (DGL. SC.).

—. Blotches forming dark pattern of corium with dim margins, gradually passing into light ground. . . . . 4.

4. Body relatively broad, about 1,9 times as long as wide. Pronotum more transversal, nearly 3,5 times as wide as long. Hemielytra narrowing distinctly in apical half. Pattern hardly visible, when more distinct, then in middle of corium the blotches forming a transverse stripe. Wings short, reaching at most middle of sixth abdominal tergite. Lateral tongue of fifth abdominal tergite, free lobe of eighth segment and parameres of ♂♂ as on fig. 67—78 [Pl. XXVII]. . . . . *M. carpatica* sp. n.

—. Body more elongated, twice as long as wide. Pronotum less transverse, about 2,8 times as wide as long. Blotches in middle of corium never melting into a uniform transverse stripe, remaining separate even in darkest specimens. Wings longer, reaching at least seventh abdominal tergite. Lateral tongue of fifth tergite of ♂♂ [Pl. XXV, fig. 39] crescent-like in outline, parameres of ♂♂ as on fig. 27—38 [Pl. XXV]. . . . . *M. griseola* HORV.

B. Macropterous forms

1. Pronotum 2,8 times as wide as long, a little wider than head. Hemielytra shining, dark pattern of corium streaky, its pubescence consisting of longer, erect hairs. Free lobe of eighth abdominal segment and parameres of ♂♂ as on fig. 1—11 [Pl. XXIII]. . . . *M. meridionalis* (COSTA).

—. Pronotum about 2,5 times as wide as long, much wider than head (by 13—16 per cent of head-breadth). . . . . 2.

2. Synthlipsis about 1,5 times as wide as eye-breadth. Hemielytra shining, dark pattern streaky. Lateral tongue of fifth abdominal tergite and parameres of ♂♂ as on fig. 12—24 [Pl. XXIV]. . . . . *M. minutissima* (L.).

—. Synthlipsis 1,7—1,8 times as wide as eye-breadth. Hemielytra not shining, opaque. . . . . 3.

3. Posterior margin of pronotum always distinctly convex. Body narrowing in apical half, wedge-like. Dark pattern on corium sharply marked. In ♂♂ (exceedingly rare) lateral tongue of fifth abdominal tergite and parameres as on fig. 47—63 [Pl. XXVI]. In ♀♀ projection of posterior margin of seventh abdominal sternite as on fig. 96—100 [Pl. XXVIII]. . . . . *M. poweri* (Dgl. Sc.).

—. Posterior margin of pronotum feebly convex. Sides of body parallel in about $^2/_3$ of its length. Blotches forming dark pattern of corium with dim margins. . . . . 4.

4. General coloration pale, scarcely visible blotches in middle of corium fuse forming a transverse stripe. In ♂♂ lateral tongue of fifth abdominal tergite, free lobe of eighth abdominal segment and parameres as on fig. 67—78 [Pl. XXVII]. . . . . *M. carpatica* sp. n.

—. General coloration obscure, dark pattern of hemielytra faintly contrasting with rather dark ground colour. Blotches in middle of corium separated. Lateral tongue of fifth tergite and parameres of ♂♂ as on fig. 27—41 [Pl. XXV] . . . . . *M. griseola* Horv.

VI. REMARKS ON THE PROBABLE RELATIONSHIP OF THE POLISH SPECIES OF *MICRONECTA* Kirk.

M. meridionalis (Costa) is certainly, the most aberrant of our species; it differs not only in many respects from the other species, but also to a far greater degree, than all the remaining species do among themselves. Some authors, when arranging the European species of *Micronecta* Kirk., have, therefore, placed *M. meridionalis* (Costa) and species allied with it in opposition to the other species, i. e. those approaching *M. minutissima* (L.). Hutchinson (1940) was thus right enough when he separated *M. meridionalis* (Costa) in a special subgenus — *Dichaetonecta* Hutch., though wrongly, in my opinion, parted this species from *M. scutellaris* (Stål) on base of not very important differences concerning mainly the number of bristle-like hairs on the seventh abdominal sternite.

The parameres of the ♂♂ which present the best characters for the identification of all the species of the genus, furnish also some hints for judging of their relationships. In the para-

meres of *Micronecta* KIRK. peculiar is the smallness of the left one and the fact that both have their basal parts well developed, of a complicated shape, richly provided with ridges and processes. Such structure, as well as the position of the parameres indicate, that they have adopted in this genus mainly, if not exclusively, the function to support and to direct the aedeagus.

In *M. meridionalis* (COSTA), as said above (p. 258), the parameres of the ♂♂ are altogether different in shape, when compared with those of the other Polish species of the genus. These differences show distinctly enough that *M. meridionalis* (COSTA) on the one hand and the remaining Polish species of *Micronecta* KIRK. on the other, belong to two separate groups. Nevertheless in the first, let it be a subgenus, should be placed not only *M. meridionalis* (COSTA), but also *M. scutellaris* (STÅL), *M. vitticeps* HOBERLANDT (1948) (nec HORVÁTH, 1895), and some other species resembling them in the shape of the parameres, and in many other features too, viz. in the narrowness of the palar claw, the outline of the prestrigilar flap, the peculiar outline of the free lobe of the eighth abdominal segment etc. As belonging to the second group (subgenus *Micronecta* s. str. KIRK.) should be regarded all our other species, as well as *M. leucocephala* (SPIN.), *M. wui* LUNDBLAD, *M. hummeli* LUNDBLAD, *M. vidali* POISSON and *M. minuscula* POISSON. There is not only the similarity of the parameres that is common to all of them, but also many other features, as e. g. in the ♂♂ the presence of a quite distinct lateral tongue on the fifth abdominal tergite (prestrigilar flap), the shape of the palar claw widening distally, the similar proportions of the pronotum etc.

The species of the first group seem to have preserved more primitive characters. As such may be regarded the denticulation of the left paramere (common in the *Corixinae*), the reguiar and uniform pubescence of longer hairs on the corium, the streaky pattern there, and the full development of the paramarginal bristles on the right side of the fifth abdominal tergite of the ♂♂. On the other hand the reduction of the wings in the brachypterous form of *M. meridionalis* (COSTA) is more advanced, the pronotum more transverse (both features being

in correlation), also the reduction in number of the bristlelike hairs on the terminal abdominal sternites has proceeded further.

As marks of an advanced progress in the phylogenetic development in the species allied to *M. minutissima* (L.) have to be mentioned, apart from the reduction of the denticulation on the left paramere, also the enlargement of the basal parts of both parameres, the scantiness of the pubescence on the hemielytra (the hairs shorter, scanty and unequally distributed). In the dark pattern of the hemielytra only *M. minutissima* (L.) shows the more primitive streaky condition, in all the other species prevails the tendency to a shortening of the blotches, their widening and in consequence the fusion of the adjacent ones on the corium. The big bristles or rather prickles on the hind tibiae, which in *M. meridionalis* (Costa) are still partly bifurcated, in the members of the „*minutissima*"-group are coalescent on the whole length.

Although the kinship of all species of the „*minutissima*"-group (subgenus *Micronecta* s. str. Kirk.) is obvious enough, the connections between the particular species are not always apparent. Doubtless very closely related are *M. minutissima* (L.) and *M. griseola* Horv., especially when the parameres of the ♂♂ are compared. It may be easily shown, that the right paramere of *M. minutissima* (L.) has developed from such a shape as is shown in *M. griseola* Horv. by broadening, more acute turning of the concave margin, and stretching of the end portion. Still more simple is the evolution of the left paramere, where the shaft becomes somewhat shorter and more bent. Consequently *M. minutissima* (L.) should be regarded as a younger species. On the other hand the streaky dark pattern, the big eyes, the narrow synthlipsis which approach this species to *M. meridionalis* (Costa) seem to be rather more primitive than the corresponding characters of *M. griseola* Horv. That *M. minutissima* (L.) is a young species is indicated by its rather great variability, the considerable predominance of the ♂♂ in numbers (since the deficiency of males is sometimes regarded as a symptom of old age and a degeneration of the species), lastly the ecological evidence, viz. the occurring of this species mainly in postglacial lakes, which represent relatively young biotopes.

The systematic position of *M. poweri* (DGL. SC.) is much more distant from *M. griseola* HORV. though there are several proportions in these species very similar. *M. poweri* (DGL. SC.) approaches very closely *M. wui* LUNDBLAD — an Asiatic species. The resemblance of the parameres is striking, especially in some lacustrine variants of *M. poweri* (DGL. SC.). LUNDBLAD (1936), when comparing both species, finds differences in other, less important, characters, e. g. in the relative length of the fore tibiae, or in the shape of the lateral tongue of the fifth abdominal tergite in the ♂♂. Further investigations should show whether *M. wui* LUNDBLAD is not merely a geographical form of *M. poweri* (DGL. SC.). The latter species seems to be very variable, it has also a very wide distribution area already known, and it can be expected that it is still much more extended.

A species deserving more attention to be payed to it is *M. leucocephala* (SPINOLA). Considering its male parameres *M. leucocephala* (SPIN.) seems to link *M. poweri* (DGL. SC.) on the one side with *M. griseola* HORV. on the other. Its left paramere is almost identical with that of *M. griseola* HORV., the right one on the other hand is strongly resembling that of *M. poweri* (DGL. SC.). Somewhat intermediate between both species is in the ♂♂ of *M. leucocephala* (SPIN.) the outline of the lateral tongue of the fifth tergite. A peculiar feature of this species is the reddish coloration of the hemielytral ground. The species is most likely a relic, inhabiting only the waters of the great islands in the western Mediterranean, probably from the time, when these islands were still connected with the continent. As the possibilities of migration are here limited, the species resides in little changing climatic conditions, and may be supposed to keep several features in a primitive state. Thus such shapes of parameres as in *M. leucocephala* (SPIN.) are possibly more approaching those of an ancestor of the „*minutissima*"-group than those in any other of the European species.

Assuming that the shape of the parameres in *M. leucocephala* (SPIN.) is of a more primitive kind we must conclude, that the right one, scarcely changed in *M. wui* LUNDBLAD and *M. poweri* (DGL. SC.) is developing in two directions, of which one ends in *M. minutissima* (L.), the other in *M. car-*

patica sp. n. In the first branch as intermediary seem to stand *M. vidali* Poisson (Morocco), *M. minuscula* Poisson (Algeria) and the above mentioned (p. 253) specimen from Busalla (Italy), then of course *M. griseola* Horv. In the second branch *M. hummeli* Lundblad may be regarded as intermediary between *M. poweri* (Dgl. Sc.) and *M. carpatica* sp. n. Some specimens described as *M. wui kashmirica* Hutchinson (1940) show a similar tendency.

As to the left paramere, *M. leucocephala* (Spin.) resembles *M. griseola* Horv. Its shape in *M. minutissima* (L.) is somewhat changed; similarly but moderately and in a different manner in *M. carpatica* sp. n. As intermediate (between *M. griseola* Horv. and *M. carpatica* sp. n.) may be considered the left paramere of *M. vidali* Poisson and again of some specimens of *M. wui kashmirica* Hutchinson (1940, fig. 46, 47, 49). In other specimens of the same subspecies (Hutchinson, 1940, fig. 45 and 48) the shape of the left paramere shows a very interesting transition to *M. poweri* (Dgl. Sc.). In my opinion in *M. wui kashmirica* Hutch. there are two different species mixed, both of which have but little in common with *M. wui* Lundblad.

Of the other characters the lateral tongue of the fifth abdominal tergite of the ♂♂ (prestrigilar flap), which has in each of our species a different outline, may be of use in phylogenetic discussion. If we assume thus, that such a shape as seen in *M. leucocephala* (Spin.) is primitive, then in *M. griseola* Horv. it has undergone the least changes. In *M. minutissima* (L.) and *M. carpatica* sp. n. the tip of the tongue became blunt, or more often (in *M. carpatica* sp. n. always) rounded. In *M. poweri* (Dgl. Sc.) this tongue reveals a special development, it is stretched inwardly and normally pointed. *M. wui* Lundblad does not almost differ in this regard from *M. minutissima* (L.), according to the statement of its author (Lundblad, 1933, p. 460).

Concerning coloration, such pattern of the hemielytra as is known in some Asiatic species, e. g. in *M. siva* Kirk., consisting of four dark unbroken lines along the corium, of which the two outer ones are confluent apically and the two median basally should be regarded as most primitive. In the course

of evolution the lines probably became broken to fragments, the blotches preserving the original streaky character. Such a state is kept in *M. meridionalis* (COSTA) and also in *M. minutissima* (L.). A further step is shown in *M. griseola* HORV., where the fragments are growing in breadth, but the blotches remain separate. The last stage may be seen in *M. poweri* (DGL. SC.). The fusion of adjacent blotches causes the forming of a zigzag-like stripe in the middle of the corium. A similar pattern, only scarcely visible, is also characteristic for *M. carpatica* sp. n.

The wing reduction in the brachypterous forms is the least in *M. minutissima* (L.) and on the average somewhat greater in *M. griseola* HORV. The wings seem to be more shortened in *M. poweri* (DGL. SC.) and still more so in *M. carpatica* sp. n. They are most reduced in *M. meridionalis* (COSTA).

Any arangement of our species is only partly satisfactory, considering the above remarks. Primitive characters are often mixed in the same species with progressive ones. Thus, e. g. a rather primitive coloration in *M. minutissima* (L.) is combined with an advanced development of the parameres; in *M. carpatica* sp. n. a highly specialised right paramere is found with a little changed left one. An apparent progress in the pattern of the hemielytra, in the development of the prestrigilar flap and of the left paramere in *M. poweri* (DGL. SC.) goes hand in hand with the primitiveness of the right paramere. Taking all these facts under consideration, the order of the species given in this paper seems to be the most justified for the time being. Doubtlessly, further studies on *Micronecta* KIRK. in the future, especially on the Asiatic representatives of the genus, will enable us to undertake a better founded analysis of the phylogenetic relations between our species. Then the above interpretation of the discussed characters, as being more or less superficial may prove to be wrong too.

The geographical distribution of the recent species of the genus would also throw some light on their phylogeny. Unfortunately our knowledge of these matters is far from sufficient, and limits therefore considerably any possible conclusions.

The Oriental Region, from which over 20 widely different species of the genus *Micronecta* KIRK. are already known,

where moreover two other genera of *Micronectinae* are occurring, could be regarded perhaps as the area of origin of this subfamily. In several species from that region some morphological characters are preserved in a primitive state; some, e. g. in the pattern of the hemielytra and in the shape of the parameres are not found anywhere else. Some species reveal certain connections with the *Corixinae*. Beside species big in size there also live the smallest ones (*M. pumilio* LUNDBLAD, 0,8 mm long).

From that zoogeographical region originate probably our species of the genus, although among the known species living there at present there can not be shown any definite ancestor of them. The whole „*minutissima*"-group may be supposed to have developed from some mountain species adapted to cooler waters, for such a species would be capable of enduring the conditions of the more northern territories of Asia and Europe. Nevertheless *M. leucocephala* (SPIN.), which I take for the most ancient of the European species and the one approaching most the ancestor of this group, is really a southern form.

As an earlier separated species may be considered *M. wui* LUNDBLAD, which spread over the waters of the temperate zone of Asia, and on the western borders of its area gave origin to *M. poweri* (DGL. SC.), which differs from it only slightly. The latter is best adapted to the cooler waters, and therefore reaches farthest to the north in Europe. In Middle and Southern Europe it mainly inhabits the mountain streams and streamlets.

M. griseola HORV. is certainly a more southern form. It is the commonest species in Poland. Probably it did not follow the retreating glaciers as early as *M. poweri* (DGL. SC.). Its distribution over Middle Europe could have taken place later on, when the connection of the British Islands with the continent no longer existed. Thus, *M. griseola* HORV. is missing in the British Isles.

M. minutissima (L.), which descends probably from *M. griseola* HORV., was originally separated either as an ecological — lacustrine form or a geographical form with a northern inclination. Its spreading over the northern regions must have been almost simultaneous with that of *M. poweri* (DGL. SC.)

since both these species occur in the British Isles and in the Scandinavian Peninsula as well (Sweden). As a young species *M. minutissima* (L.) was of course plastic enough, and more readily adapted itself to new conditions, expanding earlier over newly formed postglacial lakes. The probability of these suppositions would increase, were it proved to be correct that *M. minutissima* (L.) does not occur southwards of 50° of northern latitude, and does not pass the Sudety and Karpaty Mountains (see p. 285).

M. carpatica sp. n. has penetrated to our country doubtless from the south, passing the Low Beskid Mountains, and probably not long ago. Nothing is known of the distribution area of this probably old species. It may be a Balcanic form connected with mountains. In the spreading of this species the Danube and its tributaries might have been of importance. Scarcely conceivable is any spacial relation between *M. carpatica* sp. n., *M. hummeli* LUNDBLAD and *M. wui kashmirica* HUTCHINSON, despite some resemblances in the parameres.

The ancestor of *M. meridionalis* (COSTA), which must have been common for it and for *M. scutellaris* (STÅL), had probably a southern inclination. The track of *M. meridionalis* (COSTA) westwards passed supposedly through Asia Minor. The species reached the Mediterranean and dispersed over the adjacent lands, reaching even England. It came certainly to Poland through the Moravian Gate, and from Silesia has extended to Great Poland. Further investigations will show, whether *M. pusilla* HORV. (= *M. capitata* HORV.) is not only a geographical form of *M. meridionalis* (COSTA). Anyway it is surely closely related.

VII. ECOLOGICAL NOTES

In the few papers dealing with the ecological conditions of the habitats of the species of *Micronecta* KIRK. there are as a rule mentioned as favorable or indispensable: the shallownes of the water, the absence of plants overgrowing the bottom, and of trees overshadowing the habitat. KUHLGATZ (1911) mentions also the importance of purity of the water,

WALTON (1938) states the requirement of „substrate with very low organic content", putting this factor in the first place.

Shallow open places with bare bottom are indeed favorable, and in such places adult specimens of *Micronecta* KIRK. are most often seen, but these conditions are less necessary, than it is commonly thought. In my opinion there are several other factors more important which decide directly or indirectly of the occurrence of these insects.

Before discussing the factors of the biotopes I would like to call attention to the historical factors. They are for the members of *Micronecta* KIRK. of much more importance than for the majority of other *Corixidae*. The brachypterism of all our species (macropterous specimens occur but seldom) limits the possibilities of migration and allows the population to spread mainly in the native waters and partly in those connected with them. In cases when the connection is formed by rapidly flowing waters, the current may be a hindrance, especially for such species as *M. meridionalis* (COSTA), which I never met in running water, or *M. minutissima* (L.) seldom occurring in them. I have written above (p. 318) about migrations observed in *M. poweri* (DGL. SC.).

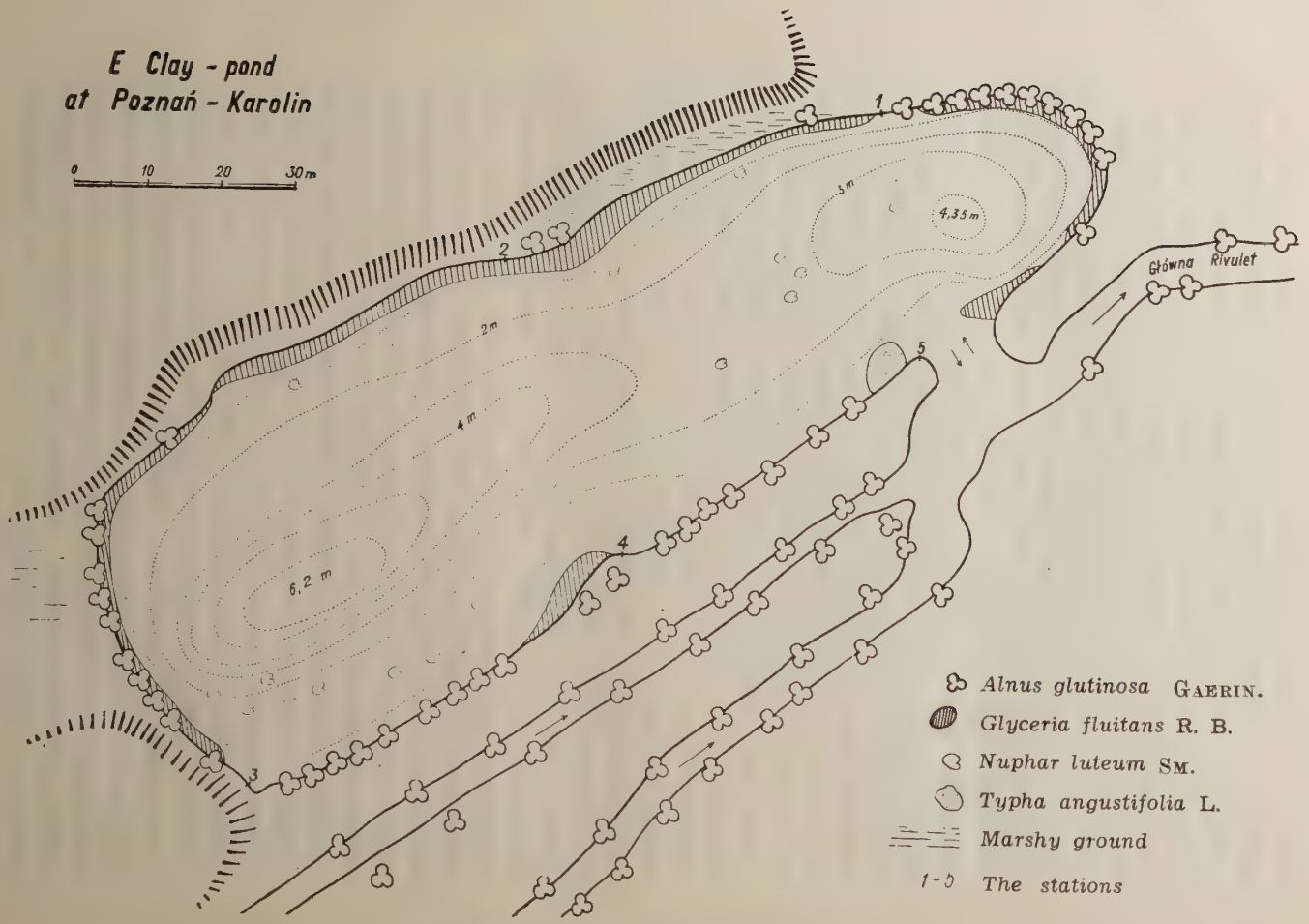
Contrary to associations formed by divers species of the genus *Sigara* F., that undertake collective flights, leaving unfavorable habitats and settling in others, in *Micronecta* KIRK. only the macropterous specimens — able to fly — can do this. Thanks to them various isolated water bodies are also often inhabited. The flights of the macropterous specimens are noticed in some species, e. g. *M. hummeli* LUNDBLAD (1934, p. 9), *M. scutellaris* (STÅL) (POISSON, 1935, p. 482), *M. siva* (KIRK.) (HUTCHINSON, 1940, p. 375, 376), which were coming to the lamp. I myself have not actually observed such flights, but since I have found macropterous specimens many times in habitats where there were no brachypterous members of the same species, they must have been immigrants. Macropterous specimens, as rare atavistic individuals, are always in their native habitats accompanied by brachypterous ones, which are as a rule many times more numerous.

The distances of the habitats, to which macropterous specimens come from the supposed original habitats,

(nearest permanently inhabited by the species in question) are sometimes considerable, reaching even 9 km, though they may have been covered by successive steps. POPHAM (1951) estimates the abilities of *Corixidae* to overcome by flight long distances by their endurance, when taken out of the water. It is the loss of body moisture, that, in his opinion, limits the possibilities. The loss is more rapid in small insects; while *Sigara distincta* (FIEB.) remains active 2—3 hours outside of water, and may cover in flight a distance of 6—9 English miles, *M. poweri* (DGL. SC.) becomes numb already after 10 minutes. In my experience the endurance of brachypterous specimens of *M. minutissima* (L.) and *M. griseola* HORV. was much greater. In dry atmosphere they remained alive during 70—110 minutes, in a moist one on the average 150 minutes. Assuming the speed in *Micronecta* KIRK. as 1 m/sec. [in *Sigara distincta* (FIEB.) it was 1,46 m/sec.], it may be supposed to be possible for it to travel in suitable conditions even 9 km in a flight. The fact of an actual spreading of a species through macropterous specimens I have stated in the case of *M. meridionalis* (COSTA) in the Zielonka Lake (p. 264), where the immigrant specimens gave origin to a new population of this species.

Quite often the specimens arriving at a new habitat find it unfit to live in and to reproduce. Of the macropterous ♀ of *M. minutissima* (L.) at Edwardowo (p. 282) no progeny was found there afterwards. *M. meridionalis* (COSTA) found in the Kierskie Lake (WRÓBLEWSKI, 1939 a) did not multiply, and the species disappeared there entirely. The lasting occurrence is of course determined by the possibilities of permanent satisfactory food and oxygen supplies. The habitat must offer adequate conditions for the larval development and for hibernation, must be free of injurious chemical, physical and other factors.

The needs of every one of our species are somewhat different, and therefore in various habitats occur various associations of species of *Micronecta* KIRK. Nevertheless several needs are common to all our species of the genus. The E clay-pond at Poznań-Karolin, where I made my phenological observations, presents a habitat suitable for as many as four of our species



Map 6. The E clay-pond at Poznań-Karolin.

(all except *M. carpatica* sp. n.), because all of them are permanent inhabitants of this pond (at least during the last four years), and all are quite numerous. I think it proper to characterize this interesting pond, treated in my investigations in a particular manner. The description should also help to estimate the significance of the particular ecological factors.

The E clay-pond of Karolin is situated near the NE boundary of the town of Poznań, within the valley of the Główna Rivulet. It arose through the filling up by water of an old clay-pit, exploited in 1930—1935. The dimensions, depth and the location are clearly seen from the map 6. The SSE bank I shall call further „southern", the opposite „northern". The banks from the south and east are steep, rising to 5 m above the water-level, from the north and west they rise only a little more than 1 m. The slope of the southern bank is covered with fragments of bricks, the remaining ones are overgrown with alders some 15 years old. Also rather steep is the subaquatic slope. The coast-shoal is narrow, for the clay-bottom resists effectually the erosion of the waves, which are here never too strong. In two places only the shoal is broader, namely in the middle of the northern bank, where once was the connection with the Główna Rivulet, and towards the west, where the clay-pond communicates with this rivulet at present. Only in these two places the bottom is sandy or even covered with gravel. In other places it is clayey, at the southern shore for $^3/_4$ of its length strewn with brick-debris. In the deeper parts the bottom is covered with a rather thin layer of black mud and fallen leaves.

The water of the pond comes partly from underground sources, leaking out of a watered stratum broken in the exploitation of clay, it is interchanged also with the Główna. The level of this rivulet is subject to frequent and considerable fluctuations, depending on the activities of water-mills up-stream. During high level the water of the Główna pours of course into the clay-pond, when low it flows out. The broad shoal opposing the connection with the rivulet is clearly the result of these influences. The water in the eastern half of the pond is also more stagnant, in the western, however, it is often and extensively exchanged.

The oxygen content observed at noon on July 21, 1956, in the deepest place of the pond was:

at the surface	8,8 mg O_2/1 l.	at	22,5° C
„ a depth of 2 m	3,0 „ —„—	„	19,9° „
„ „ „ 4 „	1,0 „ —„—	„	13,0° „
„ „ „ 5,85 m	0,6 „ —„—	„	8,5° „

On the same day pH was 6,8. The highest value of it observed in July, 1954, was 7,2 in the eastern part of the pond. Remarkable is the purity of the water. Never have I observed in the pond any distinct water-bloom, the transparency on July 21, 1956, somewhat diminished by a clay-suspension, was 220 cm.

The vegetation (vascular plants) of the clay-pond is generally poor. The reed-swamp narrow and scarce, composed mainly of *Glyceria fluitans* R. B., widened in the middle of the S shore where grow additionally *Acorus calamus* L., some *Sagittaria sagittifolia* L. and *Berula angustifolia* KOCH. In the SE nook an admixture of *Phragmites communis* TRIN. and *Carex* sp. is found. In the muddy bay E of the „cape" in the middle of the N shore, apart from abundant *Carex* sp. grow *Mentha aquatica* L., *Rumex hydrolapatum* HUDS. and *Equisetum palustre* L.; on the other side of the „cape" a clump of *Sagitta sagittifolia* L. Near the outlet to the Główna Rivulet there is a strong growth of *Typha angustifolia* L. Among *Glyceria fluitans* R. B. may be seen here and there *Hydrocharis morsus-ranae* L. and scarce *Spirodela polyrrhiza* L. Along the N shore occurs mainly *Nuphar luteum* SM. rather dispersed, more numerous near the „cape". Immersed plants are still less abundant. Where the bottom is more flat, may be seen scanty meadows of *Elodea canadensis* MICHX., among *Glyceria fluitans* R. B. incidentally occurs *Myriophyllum spicatum* L., finally here and there, mainly in the outlet to the Główna is a growth of *Ranunculus circinatus* SIBTH.

The fauna of this pond seems to be more rich. A. TSCHUSCHKE found in the zooplankton, taken on July 21, 1956, as many as 25 forms of 21 species of *Cladocera*. Among those less common he found *Polyphemus pediculus* (L.), *Scapholeberis aurita* (FISCHER), *Pleuroxus aduncus* (JURINE) and *P. uncinatus* BAIRD. Prevailing are apparently lacustrine species. The influence of the Główna

Rivulet is manifested by the occurrence of *Scapholeberis mucronata* (O. F. MÜLLER). Two species, namely *Alona costata* G. O. SARS and *A. quadrangularis* (O. F. MÜLLER) are characteristic for slightly acid waters. Finally *Sida crystallina* (O. F. MÜLLER) should be mentioned as indicating the relatively high purity of the water. The richest — containing 13 species — sample was taken near the „cape" in the middle of the N bank.

The bottom animals are also numerous. The *Tendipedidae*, examined by E. SMOLEŃSKA, are represented by the larvae of 24 species (or rather groups of species). The lacustrine forms among them are less numerous, prevailing are such which are typical for small water bodies. Especially abundant is *Tanytarsus mancus* V. D. WULP., an indicator of clear waters with high oxygen-content. From the *Heteroptera*, apart from the species of *Micronecta* KIRK. there occur but few others. According to my experience, *Corixinae* seem to avoid stations inhabited by *Micronectinae*. I have never and nowhere found more numerous populations of *Sigara* F. in habitats of any species of *Micronecta* KIRK. Also in the clay-pond in question were found only occasionally single specimens of *Sigara falleni* (FIEB.), *S. striata* (L.) and *S. semistriata* (FIEB.), mostly at the junction with the Główna Rivulet, which itself is fairly rich in *Corixinae*. In the bay E of the „cape" I have taken on August 13, 1953, a ♂ of *Notonecta viridis* DELC., rare in our country.

In the course of investigations I have usually taken samples at the five stations marked on map 6, namely:

1. At the S shore, near the W end of the pond, where the steep bank fallen down has formed a semicircular shoal strongly inclined, with bare clay bottom.

2. The same shore in the middle. A wider (2 m) shoal formed by the ground-water, leaking here more abundantly from the bank above. The muddy bottom is coverd with brick-debris and scantily overgrown with *Elodea canadensis* MICHX. and *Myriophyllum spicatum* L.

3. The N part of the E shore. The narrow (1 m) shoal, flatly sloping is formed by the clay heaped here and afterwards fallen down. The shoal is sheltered by a fairly broad reed-swamp.

4. The „cape" in the middle of the N bank with a broad, flat shoal (formed by the Główna Rivulet which formerly was connected with the pond just here). The bottom is on the W side bare and sandy, on the E side muddy, covered with detritus, overgrown by *Elodea canadensis* MICHX., *Myriophyllum spicatum* L. and *Ranunculus circinatus* SIBTH.

5. The part of the N bank from the E side adjacent to the present outlet towards the Główna Rivulet. The bottom of the very wide shoal is here flat, sandy or even covered with gravel. It is bare, with a thin layer of detritus, thicker in the recess sheltered by a growth of *Typha angustifolia* L.

At all the stations, excepting the fourth, I have found all four species of *Micronecta* KIRK. occurring in this pond, though very seldom all of them at the same time. The abundance, the components of the association and the numerical relations between the species forming them were greatly varying during the year.

At the first station *M. meridionalis* (COSTA) prevailed in numbers since its spring appearance. As an addition occurred here quite regularly *M. minutissima* (L.) and *M. griseola* HORV., disappearing only in late summer. *M. poweri* (DGL. SC.) was found here sporadically, more abundantly in spring [earlier than the adults of *M. meridionalis* (COSTA)] and single specimens in the end of July and the beginning of August (second generation).

At the second station the population was approaching that of the first, *M. poweri* (DGL. SC.) being here much less numerous, and in summer missing completely. The other species also became very scarce here in summer, probably avoiding the cooling ground-water flowing here down the quaggy bank.

The third station was remarkable by its poverty in species of *Micronecta* KIRK. The water was here always warmer, especially in spring, so the appearance was some days earlier. A constant inhabitant there was *M. meridionalis* (COSTA), often enough in company with *M. minutissima* (L.), which was less numerous. Sometimes in spring came *M. griseola* HORV. too, and on May 20, 1953, a single specimen of *M. poweri* (DGL. SC.) was caught. In a great part of the samples,

especially in late spring and early summer, *M. meridionalis* (COSTA) was here the only species.

The fourth station, with its broad and flat shoal, and its cosy bays seems to be the most convenient place for *Micronectinae*. Nevertheless, more abundantly it was frequented only by *M. meridionalis* (COSTA), its far less numerous and not constant companion was *M. minutissima* (L.). In 1953 a steady component of the association was also *M. griseola* HORV. I never succeeded to find here *M. poweri* (DGL. SC.).

The fifth station, thanks to the immediate neighbourhood of the Główna Rivulet, shows a most different association. The predominant species is here as a rule *M. griseola* HORV., also *M. poweri* (DGL. SC.) is at this station more numerous than at the others. The rheophilism of both these species is thus manifested. The clay-pond is chiefly the hatching and breeding place for their progeny, and the adults leave the pond entirely or partly, passing to the rivulet. *M. meridionalis* (COSTA) and *M. minutissima* (L.) are at this station almost always present too, but seldom in greater numbers. This is the only place in this pond where *M. meridionalis* (COSTA) does not gain numerical domination. It distinctly avoids running water.

In spring samples all species are generally mixed. Probably the larvae, having hibernated on the deep bottom nearer the centre of the pond, move in early spring towards the nearest shore, and only later the adults change the place, choosing more suitable spots, partly wandering to the Główna Rivulet.

About the behavior of every species during the year, their appearances, generations and autumn-decreases I have written above, describing separately their development. Most observations were made in this pond.

In general, judging from the ecological conditions of the described clay-pond, and basing as well on observations at other habitats, it may be stated that the needs of our species of *Micronecta* KIRK. are rather great with respect to the oxygen content, the purity of water, and its sufficient depth. The sunlight has certainly an indirect significance. As favorable, though not indispensable, should be considered the

presence of shore-shallows. The overgrowing of the bottom is no hindrance at all.

Sufficient oxygen content, which should be given the first place, is not only necessary to satisfy the needs of respiration, but it is also required to settle appropriate trophical conditions. Immediate observations on feeding of *Micronectinae* are rendered difficult by the fact that the animals hide with their bodies almost all „manipulations" executed with the palae and the rostrum underneath. The content of the stomach examined by WALTON (1938) in *M. poweri* (DGL. SC.) revealed a homogenous mass of green and brown matter. The suggestion of that author, that minute plants and animals constitute the food supply seems only partly probable; I have never seen yet the sucking out of filamentous algae by *Micronectinae* as described by WALTON. In my opinion organic minute detritus and microflora covering sand-grains and other bottom components, especially *Diatomeae* and *Chlorophyceae* chiefly provide food for all our members of the genus *Micronecta* KIRK. Often I have seen in my breeds of *Micronectinae* grains of sand revolved skilfully between the palae, or small stalks passed along the body underneath, while doubtless the epiphytes were scraped off and consumed. For a better development of the microflora is necessary not only a certain fertility, presence of organic debris on the bottom, but indispensable is also an adequate oxygen supply for the oxygenating processes. For the microflora too, not for the *Micronectinae* themselves sunlight is desirable. That is the reason, why specimens of all Polish species of the genus so abundantly assemble for feeding in well aerified shallows at the water-edges, where the waves bring organic sediments, and where the decaying processes required by the microflora do not result in an oxygen deficiency.

The importance of oxygen supply for respiratory needs of the *Micronectinae* is usually underestimated. Quite common is the belief, that the demand of oxygen is in imagines wholly satisfied by getting air from the surface of the water. Many experiences in my breeds have shown that scarcity of oxygen dissolved in the water is also fatal to adult specimens. When an aquarium is deeper and the water is not aerified the spe-

cimens assemble on the walls just at the surface and die quickly.

The oxygen demands of the different species of *Micronecta* KIRK. are not the same. Least demanding of our species is certainly *M. meridionalis* (COSTA) which endures best oxygen deficiency in breeding conditions, and frequents in the above described claypond places with more scanty oxygen content. Highest needs in this regard have, to be sure, the rheophilous species: *M. carpatica* sp. n., inhabitant of the upper course of mountain stream, and *M. poweri* (DGL. SC.), which occurs in similar waters, as well as in clear rivulets, and only in such lakes of the Pomorze and Mazury Regions, which are less eutrophic. In my clay-pond *M. poweri* (DGL. SC.) lives only in the western half of it, here developing, and leaving the pond for the Główna Rivulet a few days after the last ecdysis. Of the remaining Polish species, as to oxygen, *M. griseola* HORV. seems to have a greater demand than *M. minutissima* (L.). The first lives readily in running waters and quite often together with *M. poweri* (DGL. SC.). The lacustrine *M. minutissima* (L.) occurs among others in lakes of lesser depth, more eutrophic, therefore less rich in oxygen. It is also, more often than the other species, a companion of *M. meridionalis* (COSTA), the least demanding in this respect.

Contrary to common belief, that the presence of shallows is an indispensable condition of every habitat of *Micronecta* KIRK., the most necessary condition observed by me is the existence of a sufficiently great depth. All stagnant waters, which are permanently inhabited by any species of the genus, are at least 2 m deep. It is undeniably the rule with Polish species. They are missing always in fishponds (even such which are not drained during the winter), cattle ponds, in sölls (small postglacial lakes) and all other stagnant waters, when their depth is less than 2 m. In running waters this condition of sufficient depth seems to be less decisive. Members of some of the species were often found in quite shallow streamlets, rivulets and brooks. It is a fact that also in such waters there may be scattered washed out pools sufficiently deep, but many a time the shallow flowing waters are only transitory habitats of migrating specimens, eventually stopped by some obstacle.

The condition of sufficient depth seems to be connected with the development. The larvae remain in greater depth till the fourth stage and that are mainly the nymphs (fifth stage) that approach the bank, especially when maturing. Berg (1938), who noticed such behavior in *M. poweri* (Dgl. Sc.), interpreted it as a migration of this species toward the land (in early summer), while the later living as larvae at a greater depth, as a retreat from the shore. In the lakes the hibernating larvae usually abide in the upper zone of the slope just beneath the coast-shoal, at a depth of 1—2 m, but they may descend to deeper parts too (though in smaller numbers). Berg (1938) has even found *M. poweri* (Dgl. Sc.) at 5 m, and Brundin (1949) at 11,5 m. In the Kierskie Lake (Poznań) Rzóska (1935) noticed the occurrence of *Heteroptera* up to 9 m depth. Though not identified, they must surely have belonged to *M. griseola* Horv. or *M. minutissima* (L.), which species are the only sufficiently abundant in this lake, to be found in relatively great numbers in samples taken with the Ekman-Birge and Lang bottom-samplers.

Considerable is the sensitiveness of all our species of the genus to purity of water. Pollutions, particularly when caused by various industrial sewages, exclude their occurrence entirely. The town sewages of Poznań, polluting the river Warta, permitted *M. griseola* Horv. to live twenty years ago some 10 km downstream from the town. Now the nearest habitats of this species are removed to about 20 km farther. On the other hand the excrements of animals in places where the water is well aerified cause rather favorable circumstances. Thus watering places of lake-shores frequented by cattle show usually abundant populations of *Micronecta* Kirk. Unsupportable seems to be the suspension of fine sediment carried down by the water of swollen mountain-streams. *Micronectinae* in such cases seek shelter in the clear water of the tributaries.

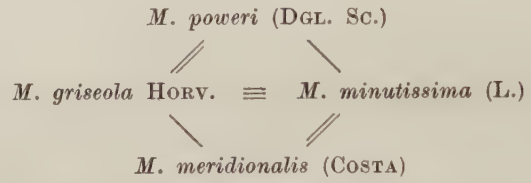
It is still difficult to say whether the presence of any natural enemies is of any consequence, i. e. whether and to what degree other animals influence the abundance of the *Micronecta*-populations. There are no records about the enemies of the members of the genus. Walton (1938) did not find *M. meridionalis* (Costa) in the stomach contents of young

carps, roaches and perch taken from a pond abundantly inhabited by this species of *Micronecta* Kirk. But also other fish should be examined, such as members of the *Cobitidae*, then *Alburnus alburnus* (L.) feeding in schools on the shallows. In my breeds I have noticed sometimes the disappearance of specimens, but only once I saw an actual assault of a long-legged *Hydrachnella* (? *Unionicola* sp.) on an adult *M. griseola* Horv.

For the phenomenon, that on long lines of shores specimens of *Micronecta* Kirk. are absent, and then at once in some place they occur in numbers, the ecological conditions not always seem to be responsible, but also, at least in some degree, the inclination of the insects to assemble. The gregarious habit is common in most of our species of the genus, and not only adult specimens reveal it but also larvae, especially in older stages. The concentrations observed are of different density. Berg (1938) records in the Esrom Lake as an average on 1 m² about 150 specimens of *M. poweri* (Dgl. Sc.) on shallows, about 500 at the depth of 1 m and some 70 at the depth of 2 m. According to Brundin (1949) the greatest abundance noticed in bottom-samples was 137 specimens on 1 m², but calculations based on estimation result in 10000—15000 specimens on 1 m² on the shoal of Björkholmen Isle on the Innaren Lake. Rzóska (1935) noticed in the Kierskie Lake as a maximal concentration 23000 specimens, doubtless *M. griseola* Horv. or *M. minutissima* (L.) or both of them, on 1 m². The specimens of *Micronecta* Kirk. being very agile must escape the bottom-sampler in numbers, so that visual estimation is in this case surely more reliable. In the described clay-pond at Karolin the density of the association near the shore was usually about 5000 specimens on 1 m², but it reached also over 20000. The extraordinary concentration, which I met in the Rusałka Lake (Poznań) on July 23, 1954, amounted to 50000 specimens of *M. minutissima* (L.) on 1 m².

The sociability of *Micronecta* Kirk. is revealed too in the occurrence of members of more than one species together. Evidently those species are more often companions, which are more similar in their ecological demands. Out of the whole

of my samples 52,5 per cent consist of one species, in 36,8 per cent of samples two species are present, 8,8 per cent of samples present associations composed of three species, finally 1,9 per cent make samples from the described clay-pond at Karolin containing four species.



The above diagram indicates which species and how often associate. Three lines joining the names indicate the most frequent association, two lines the occurring in company fairly often, one line that they are seldom met together. *M. meridionalis* (Costa) and *M. poweri* (Dgl. Sc.) were found together only in the clay-pond at Karolin, and as adult specimens for a short time. *M. carpatica* sp. n. has for companions *M. poweri* (Dgl. Sc.) quite often and sometimes single specimens of *M. griseola* Horv.

As regards the constancy of associations of *Micronecta* Kirk. I have found that at the habitats which I investigated in 1934—1939 mainly the same species still occur. *M. poweri* (Dgl. Sc.) has entirely disappeared from the Mormin Lake (Wielonek, distr. Szamotuły) where it was found on May 16, 1937, quite abundantly (Wróblewski, 1939 b). In some cases the decrease, removal or complete disappearance was an obvious consequence of changes in the habitats, chiefly caused by their pollution.

VIII. GENERAL REMARKS ON DEVELOPMENT

A most evident rule with all our species of *Micronecta* Kirk. is that only the larvae hibernate. On the whole they spend the winter in the fourth stage, but some part of them in the third stage. I have discussed before the supposed significance of a sufficient depth for hibernating, but an essential factor linking the development with the problem of depth can not yet be pointed out.

In all my breeds of summer and autumn the development of any larvae always stopped in the fourth stage, that is in the one in which *Micronectinae* usually hibernate. This stage seems thus to be peculiar and may be considered a stage of diapause. Adequate experiments will show to what degree temperature is responsible for the course of the development. It may be, that some cooling during the fourth stage is indispensable before the passing of the next ecdysis. This cooling may be undergone by the fourth stage of the summer generation in the deeper waters of the lakes and other water bodies of sufficient depth. But in more shallow lakes and in rivers the differences of temperature are rather too small to be of significance; moreover in my breed of *M. meridionalis* (COSTA) I have got a complete cycle of development from eggs to adults in summer, in a 0,3 m deep artificial pool, although in natural conditions this species inhabits, like all others, deeper waters.

The rate of development depends of course on the temperature of the water. In spring the development in the described clay-pond at Karolin begins in a temperature of about 8°C, and first the larvae of the third stage pass the ecdysis to reach the fourth stage. The first nymphs did not appear till the water reached about 15°C. The development in deeper lakes always begins later, and also later in waters of the more northern regions (Pomorze and Mazury).

The time of the appearance of the first spring imagines is different in the various species. In the described clay-pond of Karolin, from among the four species developing in the same conditions, *M. poweri* (DGL. SC.) is always the first to mature, *M. meridionalis* (COSTA), the nymphs (fifth stage) of which appear just then, finishes its development nearly a fortnight later. *M. griseola* HORV. and *M. minutissima* (L.) follow *M. poweri* (DGL. SC.), passing through their last ecdysis some 5—7 days later, both species almost simultaneously. This succession in the time of appearance, observed during three consecutive springs, was always the same, though the appearances themselves, depending on the weather, were earlier or later. Also the intervals between the particular species may have differed by some (1—3) days.

While in spring the larvae are found rather in the same stages, and therefore the imagines of every species appear at the same time, in summer there may be found a considerable diversity. Often beside adults there occur in the same habitat larvae in all possible stages. It is the consequence of laying the eggs during the whole life of the ♀♀, i. e. during 5—7 weeks probably. Usually the younger stages, I have observed, live in the deeper littoral of the lakes and on greater depth in rivers. The differences in the biology of the larvae of the various species are difficult to notice, because the larvae resemble each other too much. Only those of *M. meridionalis* (Costa) [Textfigures 4—8] can be distinguished already in the first stages, but in the remaining species only the larvae of the last stages may be identified with some probability.

The eggs laid in spring by the ♀♀ give the second — summer generation, which is distinguished, *M. meridionalis* (Costa) excepted, by the smaller size of its members, when compared with the spring adults. The occurrence of the summer generation of imagines is common to all our species of the genus, though probably this is not a rule. In the above described clay-pond at Karolin the whole development in summer lasted about 6—7 weeks. The observations in my breedings are generally agreeing with this period. Assuming thus, that the first ♀♀ of the summer generation appear before the middle of July, it is quite possible, that their early laid eggs would in favorable conditions completely develop, producing at the end of August a third generation of adults. The recognition of the third generation is difficult in practice, because freshly metamorphosed adult specimens found in late summer may originate also from the latest eggs of the spring ♀♀. The rate of development is obviously dependent on climatic and meteorological factors. The period may be greatly prolonged, and when the spring appearance is delayed and the summer is not warm enough, then the second generation may be unable to give adults. It is so certainly in cold mountain waters. Often enough only a part, individuals hatched from the earliest laid eggs of the first generation, have the chance to pass through the whole development, the others reach only the fourth stage stopping here. This cutting off of the development on the

fourth stage is a very characteristic phenomenon in all Polish species of the genus *Micronecta* KIRK. It seems, as if the larvae in this stage would refrain from changing into nymphs (fifth stage), when there are little chances to finish the development by the last ecdysis. Consequently most of the larvae being at the end of August and in September in younger stages (I—III) continue the development to reach the fourth stage, and then stop it. In this way, levelling the different advances in development, is achieved the uniformity of the hibernating larvae. The much less numerous larvae of the third stage, found in winter and early spring, are of course those youngest specimens, which did not succeed in reaching the threshold of the fourth stage.

As to the disappearing of the imagines in late summer or autumn, the succession of species is the same as in their appearance in spring. *M. poweri* (DGL. SC.) perishes first, adult specimens of *M. meridionalis* (COSTA) endure longest.

* * *

Concluding my paper, in which I have tried to present our five species, giving their descriptions with such details of morphology, which should, in my opinion, be essential and useful in recognition, communicating my observations about their ecology, development and distribution in Poland, I must admit, that several questions remain still unexplained. Many synonyms have to remain with question marks, the types being females or completely missing. It is an urgent necessity to find in the morphology of females as reliable characters, as in the males are offered by the shape of the parameres. Many of my remarks concerning ecology and development, based on suppositions, badly need confirmation by way of detailed studies on the particular species in natural conditions as well as in appropriate breeding experiments. It is highly probable, that some of my interpretations, especially concerning the relationship of our species, will prove wrong in the light of future studies. It is my desire not only to facilitate the cognition of the *Micronectinae* but also to cause further investigations on these insects. If I succeed then the aim of my work will be achieved.

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STRESZCZENIE

Zbadanie licznego materiału zebranego na obszarze całego kraju pozwoliło na stwierdzenie występowania w Polsce pięciu gatunków z rodzaju *Micronecta* Kirk., a mianowicie *M. meridionalis* (Costa), *M. minutissima* (L.), *M. griseola* Horv., *M. poweri* (Dgl. Sc.) oraz *M. carpatica* sp. n. Wszystkie krajowe gatunki występują w dwu formach: obok znacznie częstszych osobników krótkoskrzydłych, o eliptycznym zarysie ciała, trafiają się (zazwyczaj nielicznie) osobniki długoskrzydłe, odznaczające się bardziej podłużnym kształtem i dużym

przedpleczem. Dawniej, w szeregu przypadków formy długoskrzydłe opisywano jako odrębne gatunki.

Po krytycznym przeglądzie literatury autor omawia poszczególne gatunki krajowe, podając ich synonimikę i opisy uwzględniające bardziej charakterystyczne cechy, a także zmienność w wymiarach, proporcjach i kształcie ciała oraz jego części. Po wyjaśnieniach dotyczących synonimiki, wyliczone są stanowiska z datami połowów i ilościami zebranych okazów. Z kolei autor omawia typy zamieszkiwanych przez poszczególne gatunki zbiorników, spotykane zespoły, wreszcie wysnuwa wnioski o wymaganiach ekologicznych każdego z krajowych gatunków rodzaju *Micronecta* Kirk.; przytacza też obserwacje dotyczące rozwoju w cyklu rocznym, wreszcie uwagi o rozmieszczeniu stanowisk w kraju i o ogólnym zasięgu geograficznym.

Praca jest zarazem rewizją systematyczną, opartą między innymi na zbadaniu bogatego materiału z rodzaju *Micronecta* Kirk. ze zbiorów G. Horváth, jaki uzyskał autor z Természettudományi Muzeum w Budapeszcie. Liczne opisane dawniej gatunki okazały się synonimami czterech wyżej wspomnianych. Najbardziej rozpowszechnionym w Polsce gatunkiem jest *M. griseola* Horv., nie odróżniana przez wielu autorów od *M. minutissima* (L.).

Po krytycznych uwagach o cechach uwzględnianych w opisach i kluczach autor zestawia własny klucz do oznaczania krajowych gatunków. Osobny rozdział poświęcony jest omówieniu domniemanego pokrewieństwa krajowych gatunków, głównie na podstawie kształtu paramer ♂♂ i ubarwienia półpokryw.

Ogólne uwagi ekologiczne poprzedza dokładny opis glinianki w Poznaniu-Karolinie, którą autor badał szczegółowiej, prowadząc tu właśnie swe obserwacje fenologiczne nad czterema zamieszkującymi ją gatunkami. Spośród czynników ekologicznych warunkujących występowanie przedstawicieli rodzaju *Micronecta* Kirk. autor uważa za szczególnie ważną czystość i odpowiednie natlenienie wody oraz dostateczną głębokość zbiorników. Odnośnie rozwoju autor stwierdza powszechność zimowania larw w IV stadium, z którym wiąże się prawdopodobnie diapauza. U wszystkich krajowych ga-

tunków stwierdził autor występowanie dwu pokoleń w roku, osobniki drugiego, letniego odznaczają się przeważnie mniejszymi wymiarami.

W zakończeniu autor podkreśla między innymi brak dostatecznie pewnych kryteriów do odróżniania w niektórych przypadkach ♀♀ *M. griseola* Horv. i *M. poweri* (Dgl. Sc.), co nie pozwoliło na razie na ostateczne rozstrzygnięcie paru niejasności synonimicznych.

РЕЗЮМЕ

Изучение многочисленного материала собранного на всей территории Польши дало возможность установить, что в Польше встречается пять видов рода *Micronecta* Kirk., а именно *M. meridionalis* (Costa), *M. minutissima* (L.), *M. griseola* Horv., *M. poweri* (Dgl. Sc) и *M. carpatica* sp. n. Все польские виды представлены двумя формами: наряду с гораздо более обычными короткокрылыми особями, с эллиптическим контуром тела, попадаются (обыкновенно немногочисленные) полнокрылые особи, отличающиеся более продолговатым телом и большой переднеспинкой. Прежде в ряде случаев полнокрылые формы описывались как отдельные виды.

После критического пересмотра литературы автор рассматривает отдельные польские виды, давая их синонимику и описания, в которых взяты во внимание более характерные признаки, равно как изменчивость в размерах, пропорциях и форме тела и его частей. Далее даются объяснения касающиеся синонимики, а затем приводятся местности и даты сборов с указанием количества собранных экземпляров. После этого автор рассматривает типы водоемов, в которых обитают отдельные виды, встречающиеся их ассоциации, и наконец делает выводы относительно экологических требований каждого из польских видов рода *Micronecta* Kirk.; автор приводит тоже наблюдения касающиеся развития в годичном цикле, а затем дает заметки относительно распределения в Польше мест нахождения данного вида и его общего географического ареала.

Работа является одновременно систематической ревизией рода *Micronecta* Kirk., основанной между прочим на изучении богатого материала из коллекции Г. Хорвата, который автор получил для обработки из Természettudományi Muzeum в Будапеште. Многие описанные прежде виды оказались синонимами четырех упомянутых выше. Видом найболее широко распространенным в Польше является *M. griseola* Horv., которую многие авторы не отличали от *M. minutissima* (L.).

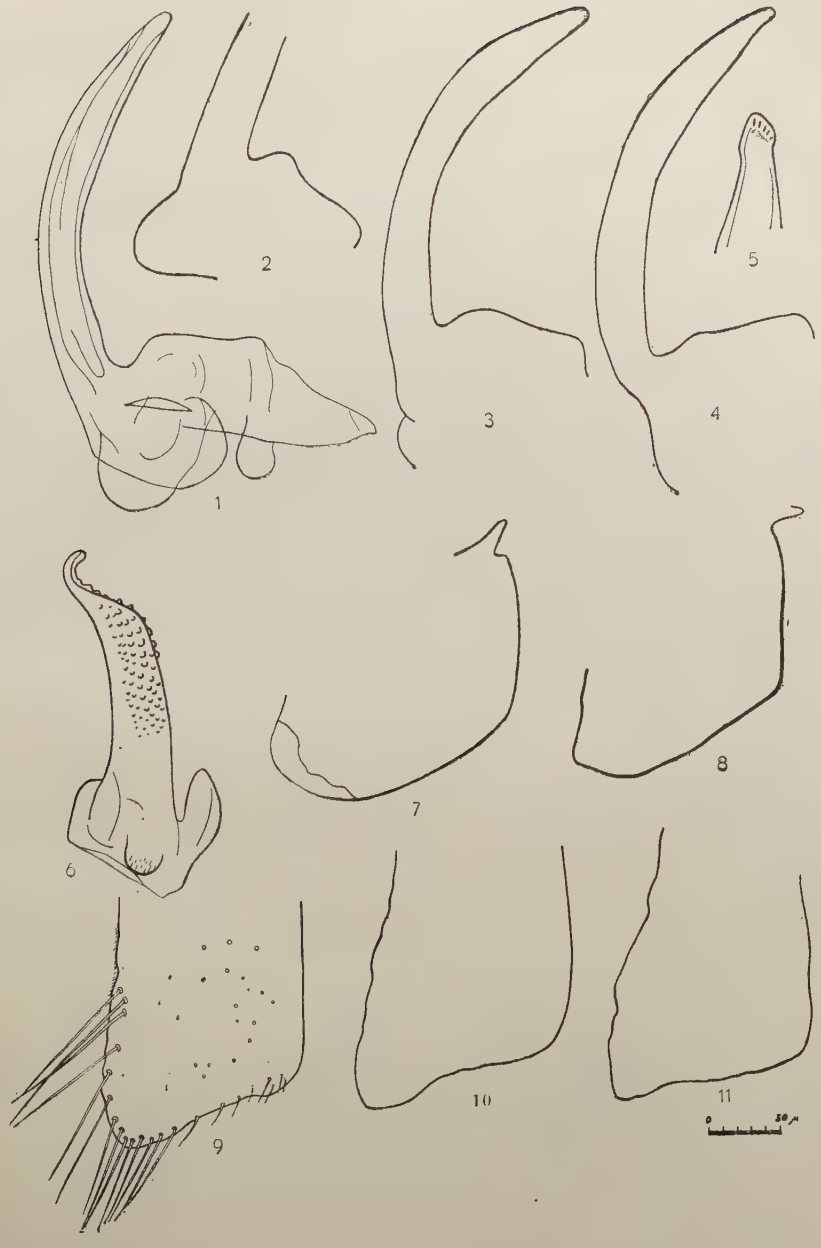
После критических замечаний относительно признаков употребляемых в описаниях и определителях, автор дает собственный определитель польских видов. Отдельная глава посвящена рассмотрению предположительных родственных отношений польских видов, причем во внимание берется главным образом форма парамер ♂♂ и окраска надкрылий.

Общим экологическим замечаниям предпосылается подробное описание водоема образовавшегося на месте выемки глины в Познане-Каролине, который исследовался автором более тщательно и где именно и проводились фенологические наблюдения над четырмя обитающими здесь видами. Из числа экологических факторов обусловливающих присутствие видов рода *Micronecta* Kirk. автор считает особенно важными чистоту воды и соответствующее содержание в ней кислорода, а также достаточную глубину водоемов. Что касается развития, то автор установил, что как общее правило наблюдается зимование личинок на IV стадии; с этой стадией связана вероятно диапауза. У всех польских видов автор нашел появление двух поколений в год, причем особи второго, летнего поколения отличаются по большей части меньшими размерами.

В заключении автор подчеркивает между прочим отсутствие достаточно надежных критериев для различения в некоторых случаях ♀♀ *M. griseola* Horv. от *M. poweri* (Dgl. Sc.), что сделало пока невозможным окончательное разрешение нескольких синонимических неясностей.

Plate XXIII

Micronecta meridionalis (Costa) ♂♂; fig. 1—5: right paramere (fig. 5: the tip enlarged twice more); fig. 6: left paramere; fig. 7 and 8: lateral tongue of the fifth abdominal tergite; fig. 9—11: free lobe of the eighth abdominal segment.



Auctor del.
A. Wróblewski.

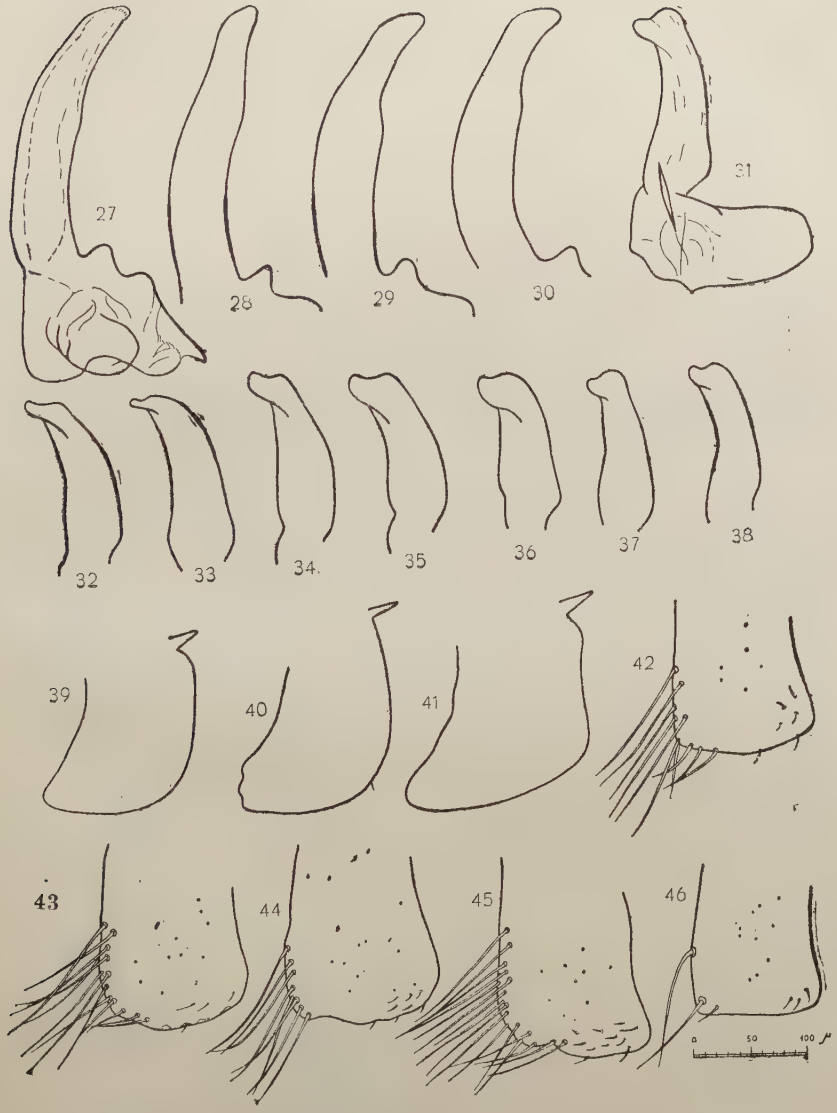
Plate XXIV

Micronecta minutissima (L.) ♂♂; fig. 12—15: right paramere; fig. 16—21: left paramere; fig. 22—24: lateral tongue of the fifth abdominal tergite; fig. 25 — 26: free lobe of the eighth abdominal segment.

Auctor del.
A. Wróblewski.

Plate XXV

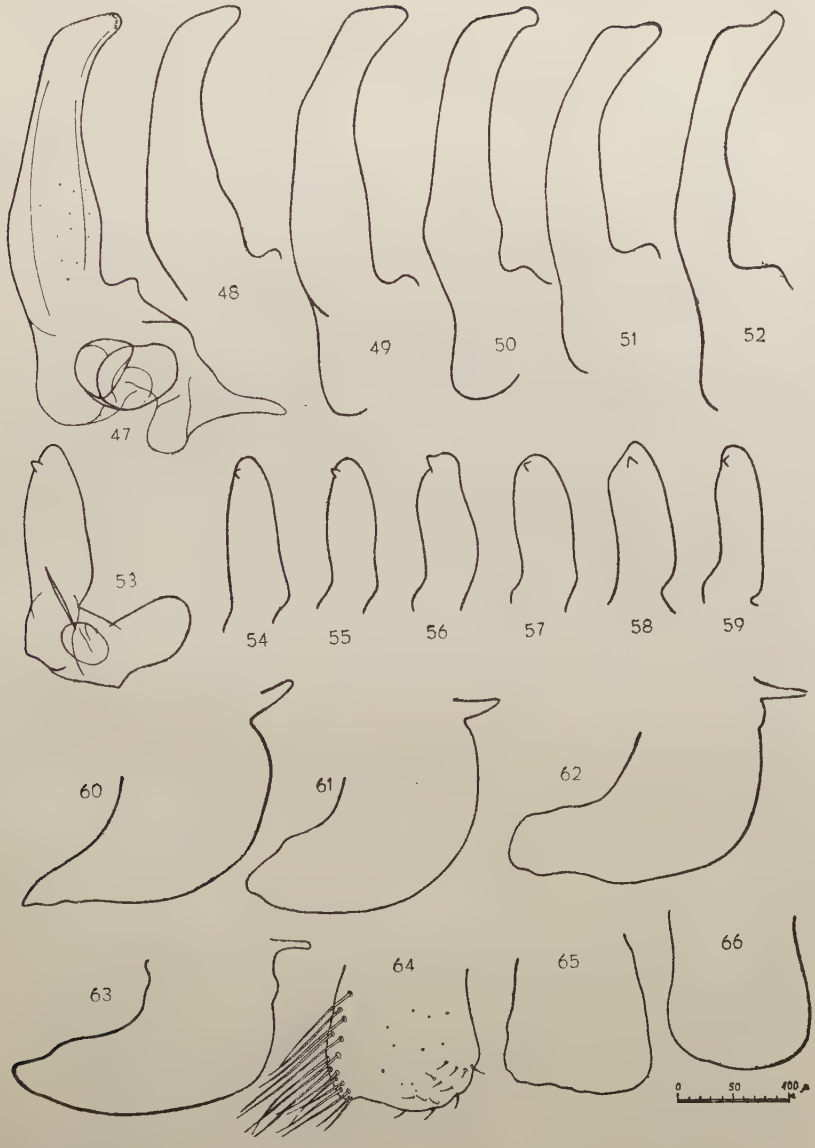
Micronecta griseola Horv. ♂♂; fig. 27—30: right paramere; fig. 31—38: left paramere; fig. 39—41: lateral tongue of the fifth abdominal tergite; fig. 42—46: free lobe of the eighth abdominal segment.



Auctor del.
A. Wróblewski.

Plate XXVI

Micronecta poweri (Dgl. Sc.) ♂♂; fig. 47—52: right paramere; fig. 53—59: left paramere; fig. 60—63: lateral tongue of the fifth abdominal tergite; fig. 64—66: free lobe of the eighth abdominal segment.



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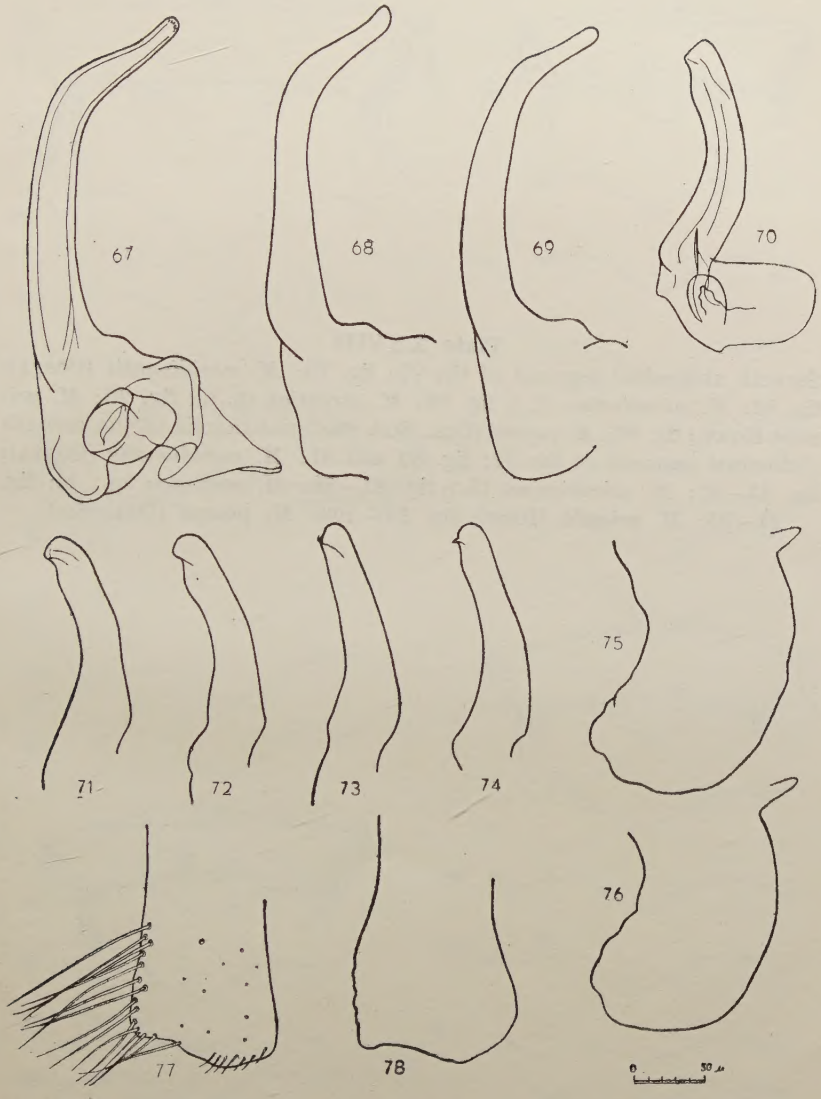
A. Wróblewski.

Plate XXVI I

Micronecta carpatica sp. n. ♂♂; fig. 67—69: right paramere; fig. 70—74: left paramere; fig. 75 — 76: lateral tongue of the fifth abdominal tergite; fig. 77 — 78: free lobe of the eighth abdominal segment.



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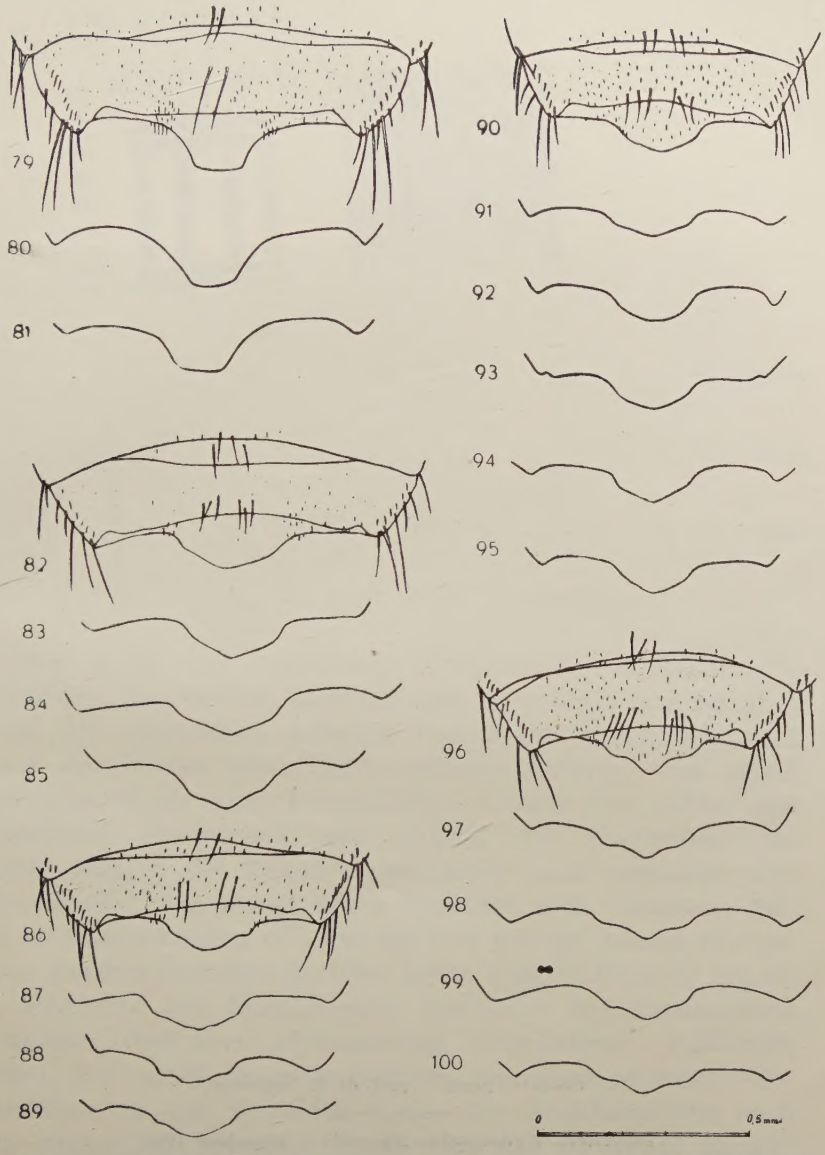
A. Wróblewski.

Plate XXVIII

Seventh abdominal segment of the ♀♀; fig. 79: *M. meridionalis* (Costa); fig. 82: *M. minutissima* (L.); fig. 86: *M. carpatica* sp. n.; fig. 90: *M. griseola* Horv.; fig. 96: *M. poweri* (Dgl. Sc.). Posterior margin of the seventh abdominal segment of the ♀♀; fig. 80 and 81: *M. meridionalis* (Costa); fig. 83—85: *M. minutissima* (L.); fig. 87—89: *M. carpatica* sp. n.; fig. 91—95: *M. griseola* Horv.; fig. 97—100: *M. poweri* (Dgl. Sc.).



Auctor del.
A. Wróblewski.

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